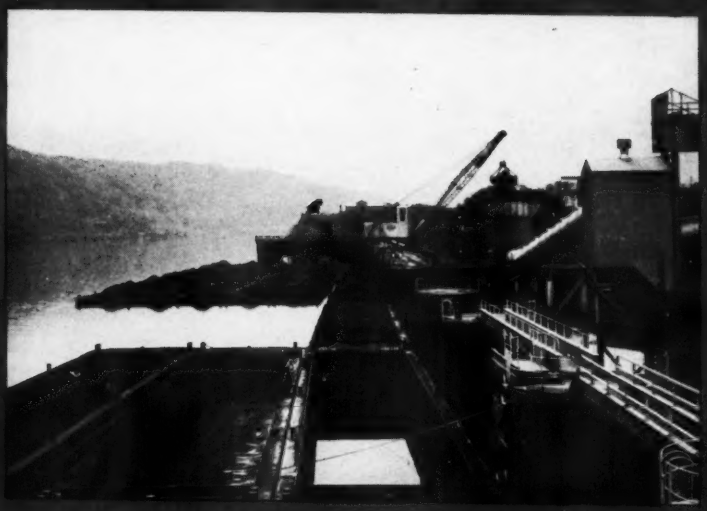
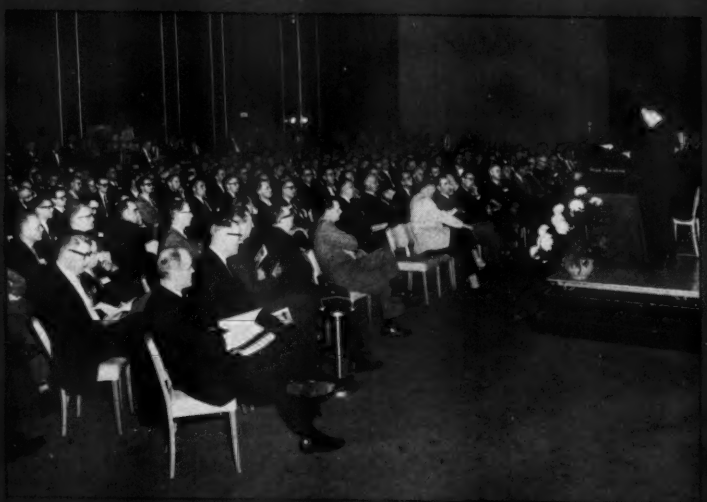
MINING CONGRESS JOURNAL

JUNE 1960





AMC COAL CONVENTION Report

ALLIS-CHALMERS

One-man, one-minute product control on these

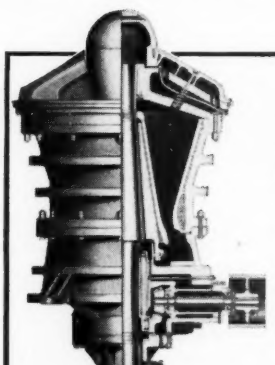
brawny boulder busters!

***Hydroset* mechanism keys *Superior* crusher performance.** For crushing the hardest materials — year in, year out — *Superior* crushers have strength where it counts. They lead the field in dependability and continuous service and, at the same time, give you high capacity and low operating costs.

Best yet, these rock-rugged crushers do it with a flip of the switch. With *Hydroset* mechanism, it takes one man less than one minute for complete product control. This exclusive mechanism compensates for wear, retains initial setting or changes settings in less than 60 seconds. Clears jams just as easily. Slashes downtime and maintenance costs to the bone.

You'll see all the top-profit advantages in Bulletin 07B7870A. For your copy, call your A-C representative or write **Allis-Chalmers,** *Industrial Equipment Division, Milwaukee 1, Wisconsin.*

A-1329



Deep, curved crushing chamber minimizes slippage, provides acute crushing angle . . . maximum capacity. A flip of the **Hydroset** switch changes crusher settings in less than a minute. No loss of production hours.

Superior and *Hydroset* are Allis-Chalmers trademarks.

MINING CONGRESS JOURNAL

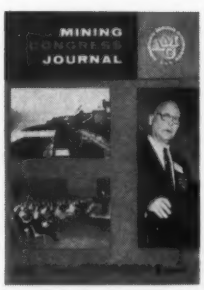
VOL. 46 JUNE 1960 NO. 6

CONTENTS

Opinions expressed by the authors within these pages are their own and do not necessarily represent those of the American Mining Congress.

ON OUR COVER

Highlights of the 1960 AMC Coal Convention in Pittsburgh . . . (upper left) the Maple Creek plant tour was one of two special trips which climaxed the Convention — (lower left) recent developments in thin seam mining were discussed at one of ten technical sessions — (right) Secretary of the Interior Fred A. Seaton pledged more coal research at the Welcoming Luncheon. See pp 41 to 54 for full details.



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RED, HOT AND STANDARD

NEW

With the Big 7 features to give you better engine performance and lower maintenance costs

Here's how you get better engine performance

Balanced volatility gives you maximum usable power. It allows PREMIER Diesel Fuel to deliver the most possible BTU's of energy without sacrificing clean-burning qualities, meanwhile assuring low smoke and exhaust odor. PREMIER's low pour point means free flow in cold weather. PREMIER's cetane means that engines start easily, idle smoothly, deliver full performance under all operating conditions.

PREMIER's anti-rust additive minimizes an important diesel engine worry—injector sticking. PREMIER Diesel Fuel is handled only by Standard Oil from refinery to you, thus the chance of fuel contamination is virtually eliminated.

Here's how you get lower maintenance costs

Deposits caused by excessive sulfur in fuel can damage the engine and increase maintenance costs. PREMIER's low sulfur content means reduced engine wear. Additives inhibit rust of engine parts and storage facilities. PREMIER's just-right viscosity results in effective injector lubrication and the prevention of leakage. Because of this you don't waste fuel or power.

Get all the facts about new PREMIER Diesel Fuel. Call your nearby Standard Oil office. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

PREMIER DIESEL FUEL

Here are the 7 big features

1. Anti-rust additive.
2. Balanced volatility—for full power and clean burning.
3. Cetane—for easy starting, good performance.
4. Free flowing—even in cold weather.
5. Low sulfur—less wear, reduced deposits.
6. Lubricates and seals injectors.
7. Distinctive red color.

You expect more from **STANDARD** *and you get it!*

KELLOGG ENGINEERS AND BUILDS FOR KENNECOTT

KENNECOTT'S NEW $30-MILLION COPPER REFINERY DEMONSTRATES KELLOGG'S ECONOMIC APPROACH TO PLANT ENGINEERING, PROCUREMENT, CONSTRUCTION

Kennecott's new plant in Anne Arundel County, Maryland, is the newest and most modern electrolytic copper refinery in the United States. A model of efficient and economical execution, it is the result of close teamwork between Kennecott Refining Corporation and The M. W. Kellogg Company—to whom Kennecott assigned over-all responsibility for engineering, procurement, and construction.

This $30-million project demonstrates how large and complex plants can be designed and built for the optimum *predetermined* investment when all phases of the job are integrated into one unified operation by a single contractor. The method and the results are typical of the way Kellogg has worked with leading oil refiners, chemical companies and ore beneficiating firms.

Many design and engineering innovations resulted from this relationship. Among them were various ways to facilitate materials handling and expedite product flow. These included: a specially designed automatic anode take-off machine; straddle trucks for moving cathodes; and semi-automatic bundling for copper billets. Plant construction also was speeded by Kellogg, and erection costs cut, by production-line pouring—right in the plant—of 1,000 huge concrete cells, and by training workers on the spot to fabricate over 95,000 feet of plastic pipe at the plant site.

The complete story of Kellogg's engineering-procurement-construction assignment for Kennecott is available to you in a 12-page folder. You are also invited to send for Kellogg's brochure—"Planning the New Plant for Profits".

THE M. W. KELLOGG COMPANY, 711 THIRD AVENUE, NEW YORK 17

A SUBSIDIARY OF PULLMAN INCORPORATED

Offices of Kellogg subsidiary companies are in Toronto, London, Paris, Rio de Janeiro, Caracas, Buenos Aires

Below is the new electrolytic copper refinery of Kennecott Refining Corporation (a subsidiary of Kennecott Copper Corporation) in Anne Arundel County, Maryland. Engineered and built by The M. W. Kellogg Company, this plant is expected to have a monthly capacity of 16,500 tons of 99.95% purity copper by mid-July.

What better testimony to the long-range economy of the new Anaconda Shuttlecar

NEW ANACONDA AC SHUTTLECAR CABLE— FOR TWO YEARS AND STILL IN EXCELLENT

Two years of constant pulling, scraping, crushing, pinching and mine water hazards—and this Anaconda *AC* Cable is still in excellent condition.

This long, minimum-maintenance life lets you take full advantage of modern, efficient *AC* equipment. Such long, dependable life is also a tribute to the advanced design of this new, three-phase *AC* cable. For it is built *flat* with parallel conductors and grounding wires to minimize mechanical damage. The conductors are protected by special-patented nylon breaker strips which greatly reduce the possibility of phase-to-phase shorts. The flat configuration also means increased protection from runover damage and—easy, fast reeling.

Equally important, Anaconda is first to give you this improved, advanced design built throughout with rugged, mine-proven Anaconda Neoprene. Anaconda's all-Neoprene (both insulation and jacket) construction withstands the torture conditions of mining and keeps on operating.

Cable—a two-year record of operation in the rough, tough service of the Independent Coal and Coke Mines of Carbon County, Utah.

IN ROUGH SERVICE CONDITION

Cross-section of Anaconda AC Shuttlecar Cable

Consider the advantages offered you by AC

Small, highly automatic, efficient and profitable *AC* mining equipment is now available. And minimum maintenance and long life of Anaconda's *AC* Shuttlecar Cable makes it even more economical for you to modernize with *AC*.

Contact your nearest Anaconda District Office or write for full details: The Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

6K2(B)

ASK THE MAN FROM

ANACONDA®

ABOUT THE NEW **AC** SHUTTLECAR CABLE

engine power
BY CATERPILLAR

WHY YOU RARELY SEE SMOKE FROM EQUIPMENT REPOWERED WITH CAT ENGINES

Some diesel engines smoke almost all of the time. They can't help it. It's the way they're made. Diesel smoke can be a minor annoyance or a major headache, depending on the way the engine is used—and where it's used.

You rarely see smoke coming from the exhaust of equipment powered by Caterpillar Diesel Engines. This is because of the way they are designed. They are four-cycle engines and each has the exclusive Caterpillar adjustment-free individual fuel injection pumps and non-fouling single orifice injection valves. This system is simple, reliable and economical.

The large single orifice on the injector does not tend to build carbon deposits or foul. You can idle a Cat Diesel without racing it to keep it from stalling out. It will idle and accept a full load instantly and faultlessly. If it's ever necessary to change the injector capsule, you simply remove the injector, unscrew the capsule and screw in a new one, then replace the injector. Anyone can do it and it takes just a few minutes. You save on maintenance costs.

The Caterpillar precombustion chamber permits use of lower cost fuels. Even then, you'll rarely see smoke because of Caterpillar's highly efficient fuel system.

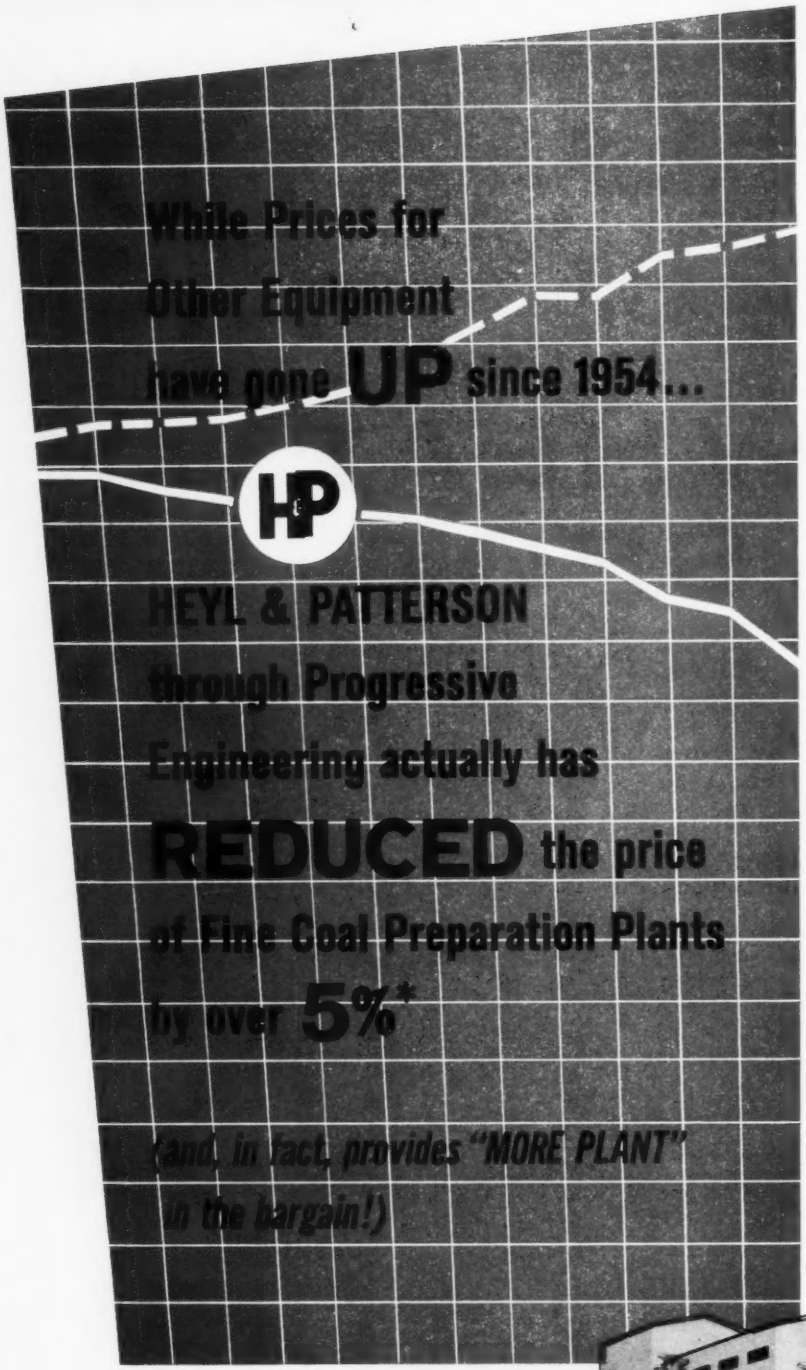
The superintendent of a water diversion tunnel project had this to say about a Plymouth locomotive powered with a Cat D326, "We can pull twice the load and not smoke up the tunnel." Performance of the Caterpillar-powered Plymouth was so outstanding, the company ordered another identical unit.

When you repower with a Cat Diesel, you save several thousand dollars a year on fuel alone, over the cost of, say, gasoline. You save on power maintenance because Cat Engines require infrequent care and are easy to care for. Service and genuine parts are available from your Caterpillar Dealer. The repowering installation is usually very simple and seldom takes your equipment out of action for much time. Compact Caterpillar Diesels put a lot of productive power in relatively little working space.

For new power or repowering, Caterpillar Diesel Engines are probably the most economical you can own. For a fraction of the cost of a new locomotive, repowering with Caterpillar can give you new equipment performance. Ask your Caterpillar Dealer for facts on repowering. He will give you a complete—and impressive—summary of the advantages to you. In the meantime, write for "Caterpillar Engines for Railroad Power" and for "Railroad Equipment Manufacturers' Machines Powered by Cat Diesels." Both will be sent free upon request.

CATERPILLAR

Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U.S.A.



Here is how we did it:

Conducting a diligent and continuous research program, we developed new products and processes for coal preparation. You too have successfully used some of these products:

- **H & P Fluid Bed Dryer**
- **H & P Cyclones with the new 24" and 36" sizes**
- **H & P Sieve Bend**
- **Reineveld Centrifuge**

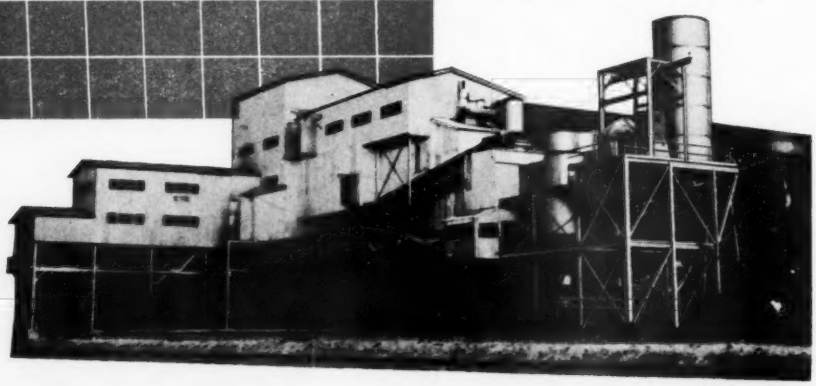
We point with pride to the real service we have rendered to the Coal Industry by being instrumental in successfully combatting inflationary trends.

In addition to lowering the initial investment, we reduced operating and maintenance costs.

In a competitive market such as coal, this means more profit opportunities for the users of H & P equipment.

Discuss your requirements with H & P engineers whose experience is at your disposal to conceive a preparation plant best suited to your own operating and marketing conditions.

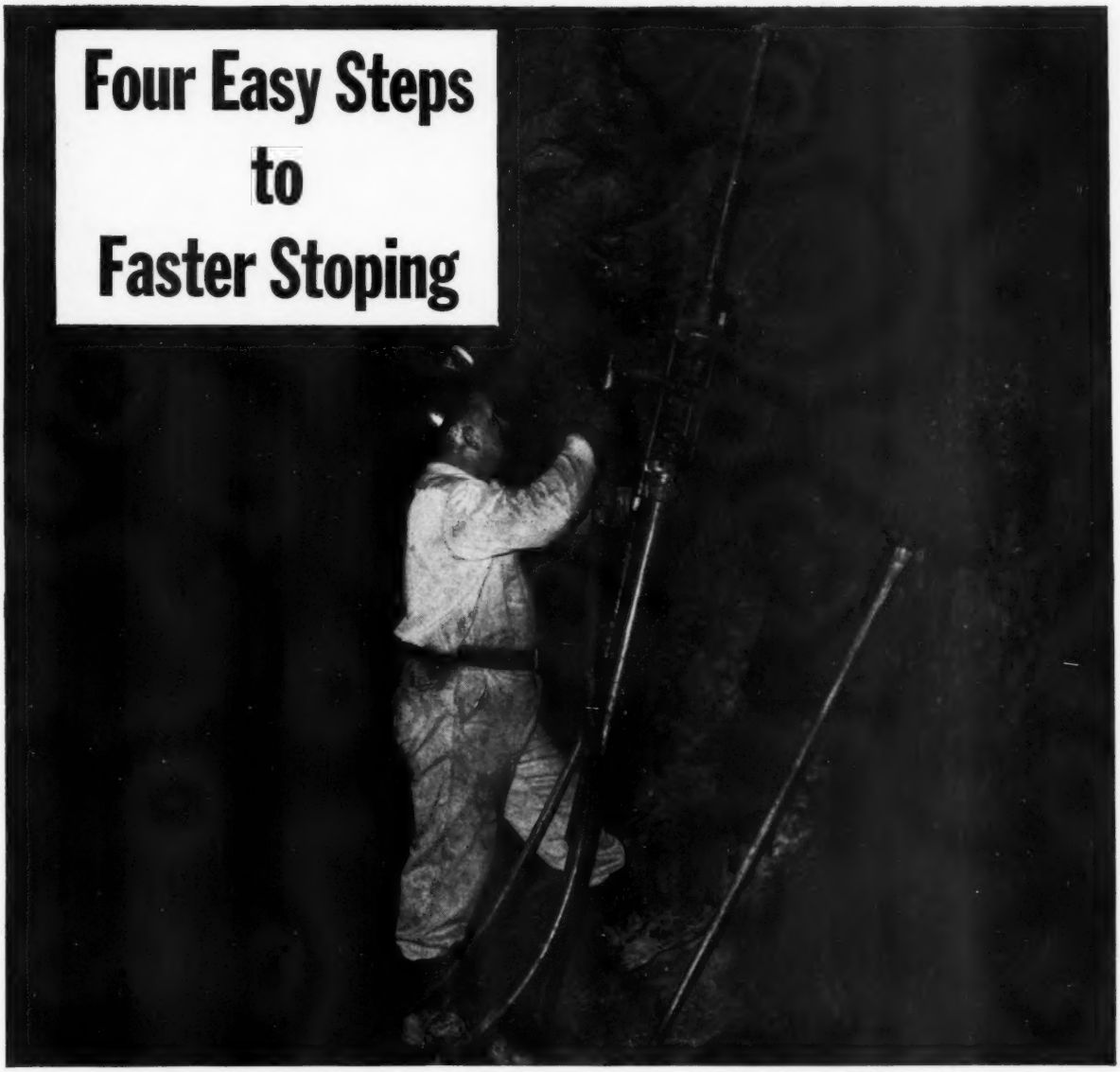
Whether you require a "turn-key" job or prefer a co-operative effort—remember: When Experience Counts—Count on Heyl & Patterson!



**Comparing on a "cost per ton of plant feed basis," the actual purchase prices of similar plants, one sold in 1954, the other now under construction.*

HEYL & PATTERSON, inc. 55 FORT PITT BLVD., PITTSBURGH 22, PA.

Four Easy Steps to Faster Stoping



	Gardner-Denver Model	R68	RB94*	RB104*
1. Choose the drill size you need	Hammer diameter	2⅝	2¾	3⅛
2. Take your choice of feeds	Direct feed (steel)	X	X	X
	Direct feed (aluminum)	X	X	X
	Telescopic direct (aluminum)	X	X	X
	Reverse feed	—	X	X
3. Specify the chuck to match your steel	Collared chuck	X	X	X
	Tappet chuck	X	X	X
4. Add the type of controls you prefer	Push-button control	X	X	X
	Rotary control	X	X	—
	Stop rotation control	—	X	X

Gardner-Denver stopers hit hard, are easy to handle, stay on the job with minimum maintenance. All have automatic water control—operate in "water on, air on . . . air off, water off" drilling cycle. Ask your Gardner-Denver mining equipment specialist for details. Write for bulletin.

*Roof-pinning models available—drill holes, drive studs and tighten nuts quickly, efficiently.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
International Division, 233 Broadway, New York 7, New York
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

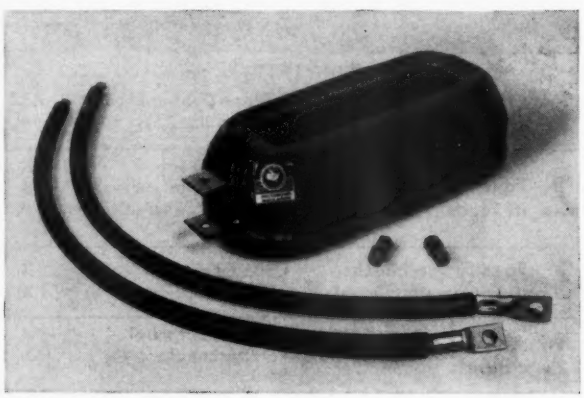
Rewound motors can be upgraded with NECCOBOND field coils by National ... *The Specialists in electric coils/repair service*

Rewinding time is an ideal opportunity to improve performance over that of the original machine . . . with the much more effective insulations available today.

For example, National manufactures field coils to your requirements with the NECCOBOND insulation system. The best insulating materials—mica and glass—are used. Then a high strength, inert epoxy resin is used to impregnate the whole coil. All voids are filled. The insulation wall is extremely tough, solid and durable.

NECCOBOND field coils upgrade performance. Coils operate cooler—insulation lasts longer and is impervious to water, oil, or other sources of trouble.

For more information call our Columbus plant—HUdson 8-1151, or the nearest National field engineer.



National Electric Coil

DIVISION OF McGRAW-EDISON COMPANY • COLUMBUS 16, OHIO

Electrical Engineers • Manufacturers of Electrical Coils, Insulation, Lifting Magnets
Redesigning and Repairing of Rotating Electrical Machines

Model 35SL
35 ton payload

REPEAT ORDERS *are Our Best Testimonials!*

Since KW-DART placed its Model 35SL on the market two years ago, it has proved its excellent performance on job after rugged job. Its 24-cubic yard capacity (struck), its extreme maneuverability and durability assure the operator maximum operation at minimum cost. The 35SL, like *all* KW-DARTs, is tonnage engineered to stay on the job.

SINCE THEIR ORIGINAL FLEET ORDERS, 6 MAJOR COMPANIES HAVE RE-ORDERED FLEETS OF THE KW-DART 35SL...SEVERAL HAVE RE-ORDERED *TWICE!*

Builders of heavy duty trucks since 1903

KW-DART TRUCK CO.

P.O. Box 321
1301 North Manchester Trafficway
Kansas City 41, Missouri, U.S.A.

Surrender Means Victory . . . with Bethlehem's Yieldable Arch

No rigid support, however strong, can forever withstand the squeezing pressures of heavy or shifting ground. The best way to control these forces is by "surrendering" a little at a time, allowing the overburden to settle naturally into a pressure arch.

The Yieldable Arch does just that. Each Arch (or Ring) is made up of segmental steel sections, overlapped at the ends as shown in the photograph. Secured around the lapped joints are husky U-bolt clamps, which are drawn up tightly enough to hold fast under normal loads. As pressures bear down, friction in the joints is overcome and the joints yield a little. This "give" transfers the stress to the surrounding material, until gradually, equilibrium is reached. At this point, the Yieldable Arch holds the line, its structural integrity maintained and mine safety preserved. After the area is mined out, you can usually take down the Arch sets and re-use them elsewhere in the mine.

Many installations of Yieldable Arches and Rings have paid for themselves within a matter of months! A Bethlehem engineer would like to discuss the full story in terms of your own special conditions. If you're interested, by all means get in touch with us.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

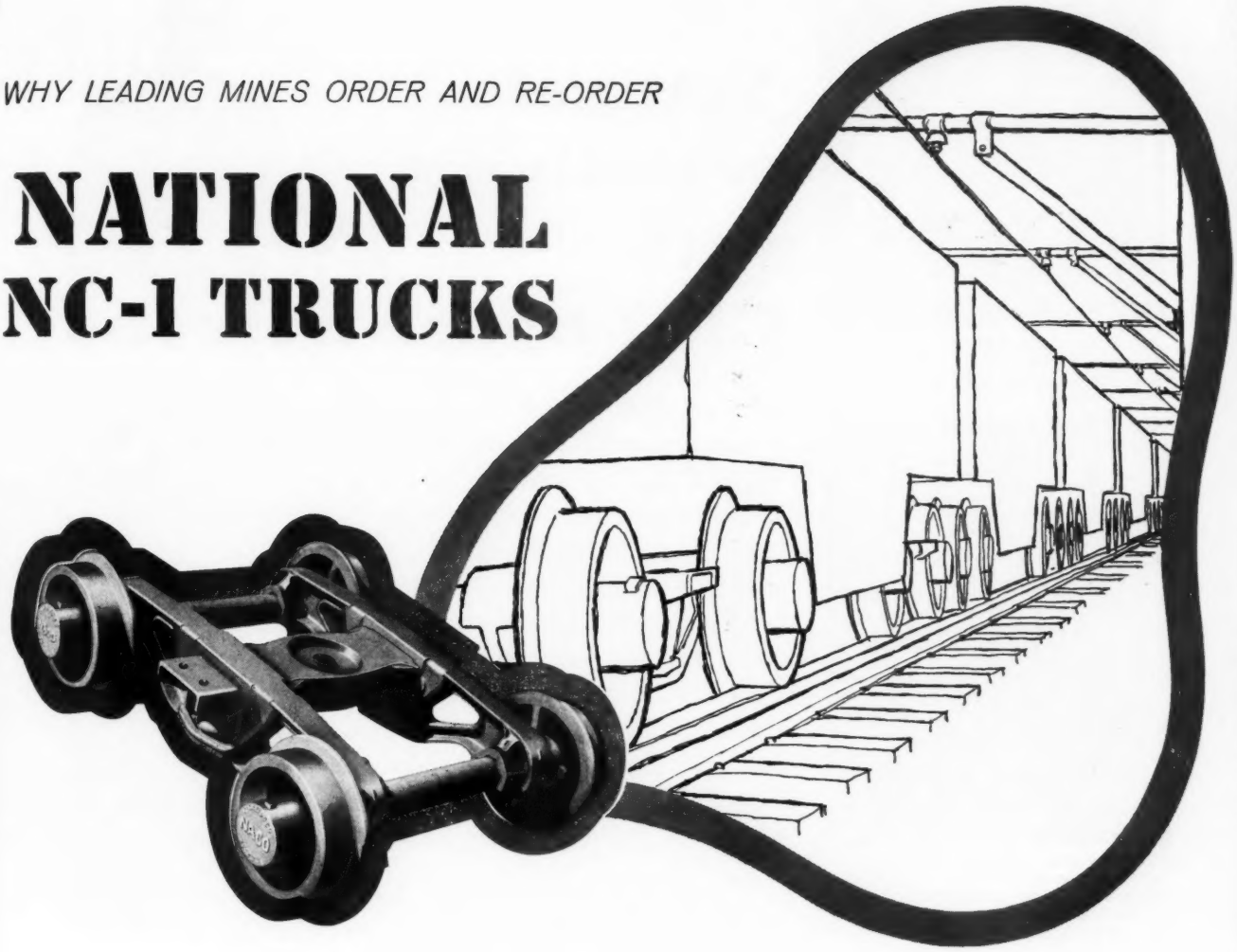
Steel *for Strength . . . Economy . . . Versatility*

BETHLEHEM STEEL

BETHLEHEM STEEL

WHY LEADING MINES ORDER AND RE-ORDER

NATIONAL NC-1 TRUCKS



The reasons for the decided swing to National NC-1 Trucks are fundamentally two: they provide safety to personnel and equipment... they make money for mine operators. There are lots of technical reasons, too. Let our representatives tell you all about them.

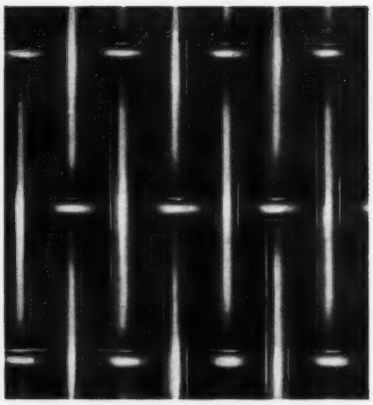
A-1792A

Mine Sales • Transportation Products Division

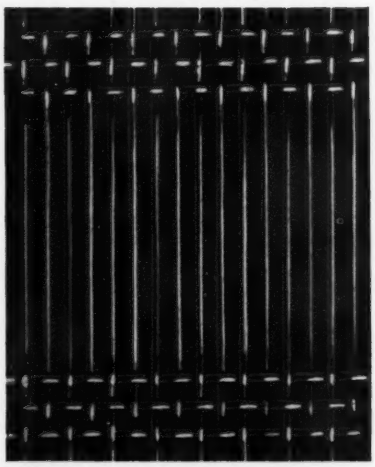
WILLISON AUTOMATIC COUPLERS
•
RUBBER CUSHIONING DEVICES
•
NACO STEEL WHEELS
•
NACO STEEL LINKS
& SWIVEL HITCHINGS

NATIONAL
MALLEABLE AND STEEL
CASTINGS COMPANY

Cleveland 6, Ohio



MAXIMUM THROUGHPUT — CF&I Space Screens with Rectangular Openings have high percentage of open area, provide considerable freedom from blinding and clogging.



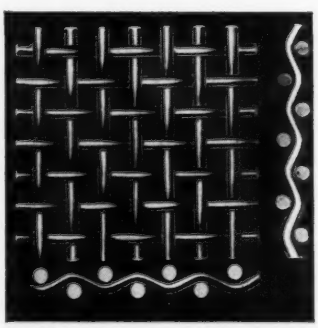
FREEDOM FROM CLOGGING AND BLINDING — The greater open area of CF&I Long Slot Space Screens, plus intense vibration of wires on the long sides of openings, prevents material build up.

You get selectivity with CF&I Space Screens

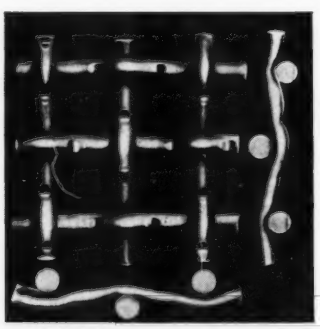
Whether you want high throughput, maximum accuracy or long service life, there's a CF&I Space Screen that will give you the results you're looking for. You can choose from screens with almost any combination of openings, weaves and crimps, edge preparations and effective open areas. CF&I has the experience and facilities — as symbolized by our Corporate Image — to supply screens to meet your most exacting requirements.

All CF&I Screens are available in a complete range of metals including carbon, alloy and stainless steels, aluminum, bronze, Monel and many other alloys. For further information on the screens described here or on any in the CF&I line, contact a local CF&I sales office.

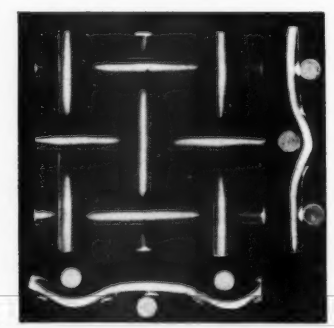
7796



LONG LIFE — Even under severest operating conditions Double Crimp cloth is most effective. That's because it's built so all wires get equal wear.



VERY ACCURATE SIZING — Because each wire of Lock Mesh Cloth is constructed in a "locked-in" position, it's one of the best available for vibrators and trommels.



MINIMUM RESISTANCE TO MATERIAL FLOW — With all the crimping on the underside, CF&I Space Screens with Flat Weave set up minimum turbulance to materials going through.

CF&I SPACE SCREENS

THE COLORADO FUEL AND IRON CORPORATION

In the West: **THE COLORADO FUEL AND IRON CORPORATION** — Albuquerque • Amarillo • Billings • Boise • Butte • Denver El Paso • Farmington (N. M.) • Ft. Worth • Fresno • Houston • Kansas City • Lincoln • Los Angeles • Oakland • Oklahoma City Phoenix • Portland • Pueblo • Sacramento • Salt Lake City • San Francisco • San Leandro • Seattle • Spokane • Wichita
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CF&I OFFICE IN CANADA: Montreal **CANADIAN REPRESENTATIVES AT:** Calgary • Edmonton • Vancouver • Winnipeg

CF&I STEEL

DEMONSTRATIONS PROVE CURTISS-WRIGHT SUPERIORITY

CW-226—26 CU. YDS. STRUCK

CWD-221—35 TON CAPACITY

CW-220—20 CU. YDS. STRUCK

CWD-214—25 TON CAPACITY

CW-215—15 CU. YDS. STRUCK

CWD-321—35 TON CAPACITY

CW-28—8.2 CU. YDS. STRUCK

CWT-30—30 CU. YDS. STRUCK

CW-320—20 CU. YDS. STRUCK

CWT-8—8 CU. YDS. STRUCK

A

Greater Bowl Factors— Faster Cycles Give Top Profit Per Equipment Dollar

You know that the machine that moves the most dirt makes you the most money — but, how do you select that machine? By past experience? No, because constantly changing models, techniques and contract conditions make this method impractical . . . By appearances? No again! You wouldn't bid a job on surface appearances alone, so why risk your profits by buying a scraper by the same method.

This leaves only one practical solution to the problem of buying a scraper. That is actual performance evaluation in the field, with a decision based on load weights, bowl factors, cycle times and the many other points that add up to high production. As one contractor says: "We considered three other major makes of scrapers for the job, but comparison and field demonstrations proved Curtiss-Wright the best machine. We feel that the added production and high bowl factors will save several cents per yard for any contractor, as it has for us."

Savings such as this are the result of buying by proven performance. See these results for yourself with a Curtiss-Wright demonstration on your job.

A C-W MODEL FOR EVERY APPLICATION

Five self-propelled scrapers with capacities from 8 to 26 cu. yds. struck, up to 36 cu. yds. heaped . . . Three interchangeable rear dumpers with 25 and 35 ton capacities . . . Six tractor-drawn scrapers with capacities from 8 to 30 cu. yds. struck, up to 39 cu. yds. heaped . . . A total of 14 high-performance machines covering the complete range of practical earthmoving applications.

SOUTH BEND DIVISION

CURTISS-WRIGHT

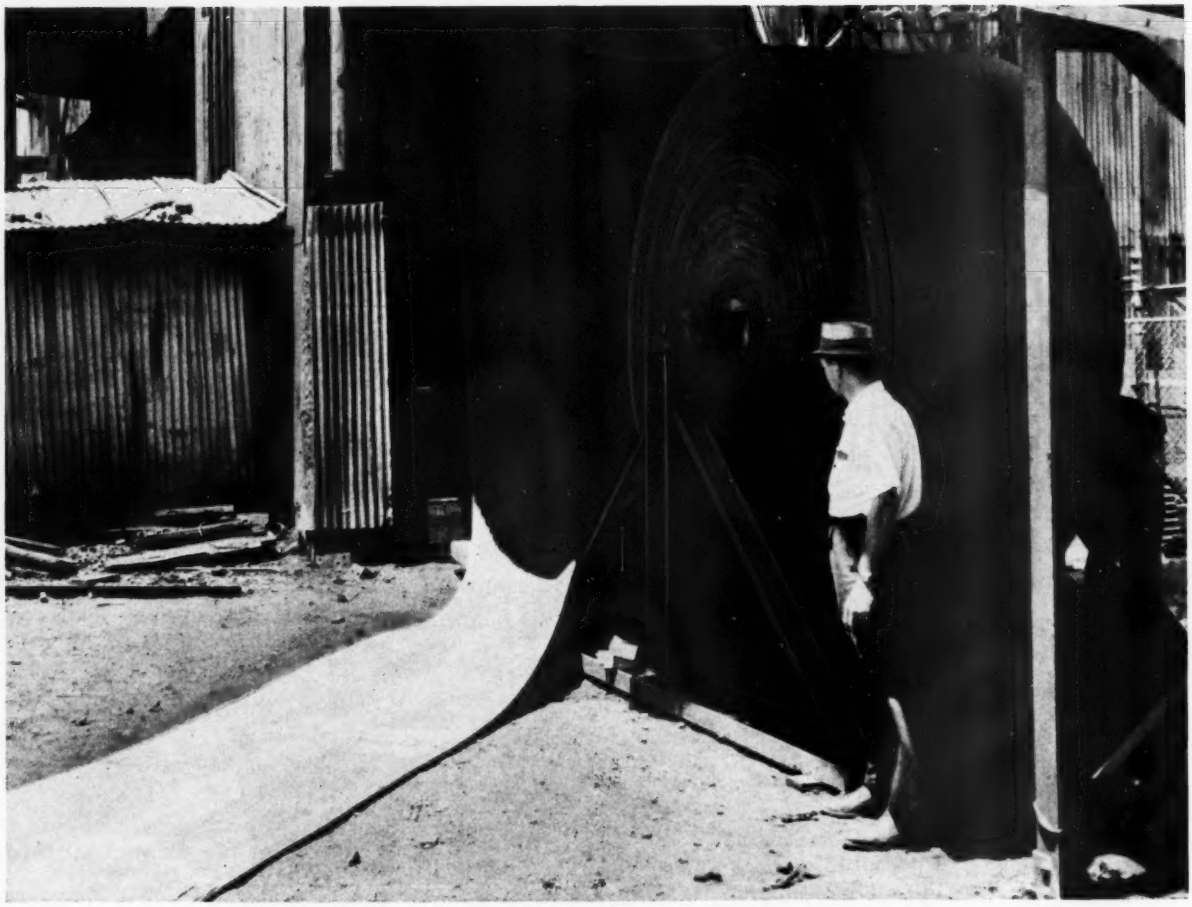
CORPORATION

SOUTH BEND, INDIANA

Distributed in Canada by Canadian Curtiss-Wright Ltd.

Ad No. 5277

US RUBBER CONVEYOR BELT



OFF WITH THE OLD, ON WITH THE NEW

20-year "U.S." veteran makes way for new "U.S." Belt

Here's why: This was a "Haul of Fame" slope belt in performance—every foot of the way. Installed in Sahara Coal Company's Mine No. 5 (Harrisburg, Ill.) over 20 years ago, this U. S. Matchless® 54" slope belt was replaced by a new U. S. Matchless.

In the 20 years, the old belt carried over 13 million tons of raw coal, plus well over a million tons of rock.

This enviable record is typical of the kind of service obtained with U. S. Conveyor Belts. The Sahara Coal Company pioneered with U. S. Rubber in the design and installation of both slope and underground belts to deliver lowest ton-per-dollar and not a belt at-a-price.

• • •

When you think of rubber, think of your "U. S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

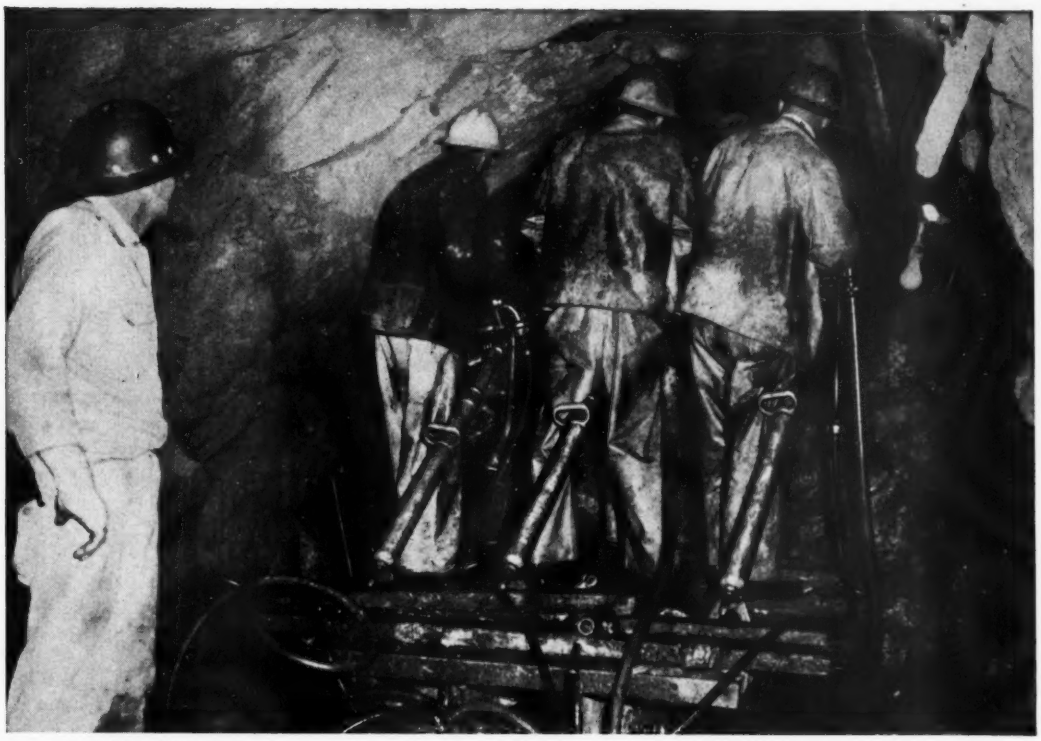
US RUBBER

Mechanical Goods Division

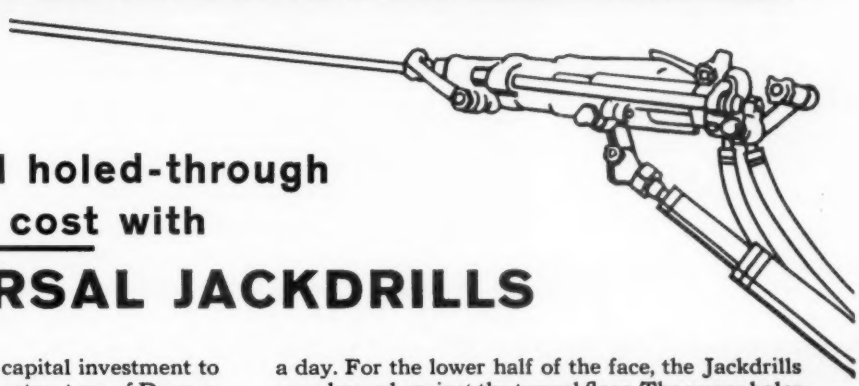
United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.



Three men on mine flat-car "jumbo" drill upper holes of a round in the 7 x 8 ft exploratory tunnel bore.



Pioneer tunnel holed-through at low overall cost with

I-R UNIVERSAL JACKDRILLS

It doesn't always take a large capital investment to do a man-size job. Colorado Constructors, of Denver, demonstrated this on an 844-ft pioneer tunnel with 7 x 8 ft bore, drilled in preparation for a full-size highway tunnel on Route U.S. 40. On this pilot bore, the drilling equipment consisted of 6 I-R Universal Jackdrills—the "jumbo" was a small mine flat car—and all air was supplied by an Ingersoll-Rand 900-cfm Gyro-Flo portable compressor.

With this simple, inexpensive equipment, 5-man crews using 3 Jackdrills at a time in two 8-hour shifts, advanced the tunnel 20 feet per day. Each round consisted of 27 holes, drilled 6 ft deep with 1⅝" and 1½" bits and each shift pulled two rounds a day. For the lower half of the face, the Jackdrills were braced against the tunnel floor. The upper holes were drilled from the mine flat car, as shown in the photos above.

With their light weight, ease of handling, simple 5-position throttle and roll-type feed-leg control valve, the Jackdrills saved setup and collaring time and maintained consistently high drilling speed at all times.

Ask your I-R engineer for complete information on the *new* JR-38C Jackdrill—more powerful and easier to handle than ever before. Or send for a copy of Bulletin 4144-B.

Ingersoll-Rand

70A5 11 Broadway, New York 4, N.Y.

A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR DRILLING ROCK

103 ways Cyanamid serves the coal industry...better

12 AMERICAN PERMISSIBLES FOR ECONOMICAL SHOOTING!

Whatever the nature of the seam, Cyanamid offers a permissible that enables you to produce more coal for less money. The American line includes a variety of low, medium and fast rate powders with a variety of densities. Our experienced explosives engineers will be pleased to help you select the proper grade for your particular requirements.

15 COAL KING® ELECTRIC BLASTING CAPS FOR IMPROVED PRODUCTION!

To permit you to benefit from the advantages of multiple blasting, Cyanamid manufactures COAL KING Split Second Delay Caps in 15 delay periods, each available in a variety of leg wire lengths. Like all Cyanamid Electric Blasting Caps, COAL KING iron leg wires are insulated with 4 concentric layers of vinyl plastic to assure dependable, safe performance.

76 OFFICES, PLANTS and MAGAZINES FOR PROMPT SERVICE!

Cyanamid's nation-wide network of plants and magazines closely parallels U. S. coal operations. Consequently, you can rely on Cyanamid for dependable delivery and prompt assistance with blasting problems.

For additional information on Cyanamid's COAL KING Caps, permissibles and blasting accessories, contact our nearest office.

*Trademark

CYANAMID

AMERICAN CYANAMID COMPANY

EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

SALES OFFICES: Denver, Colorado • Maynard, Massachusetts • Kansas City, Missouri • St. Louis, Missouri • Albuquerque, New Mexico New York, N.Y. • Tulsa, Oklahoma • Latrobe, Pennsylvania • Pottsville, Pennsylvania • Dallas, Texas • Salt Lake City, Utah • Bluefield, West Virginia
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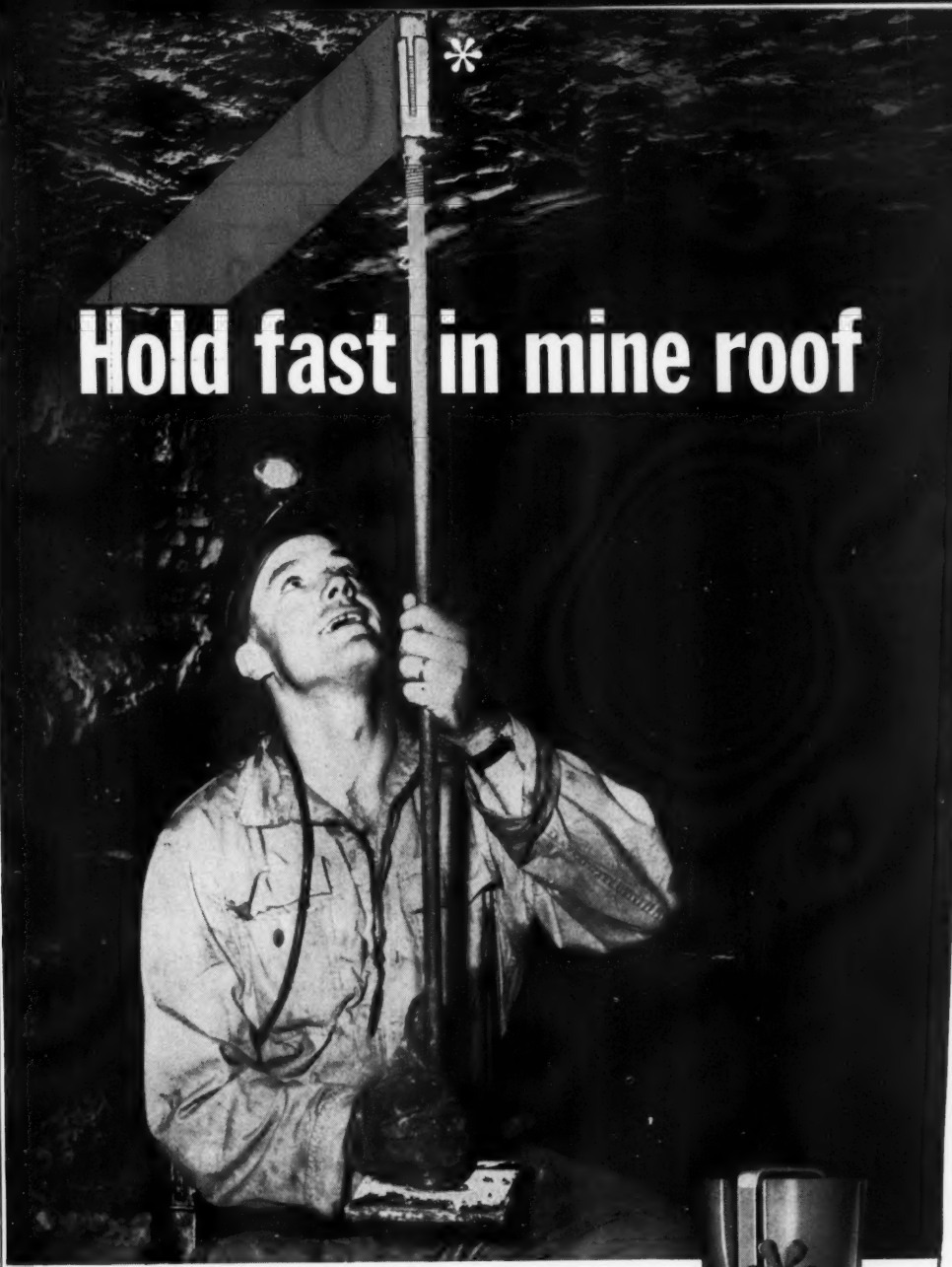
PRODUCTS: High Explosives • Permissibles • Seismograph Explosives • Blasting Agents • Blasting Caps • Electric Blasting Caps • Blasting Accessories

Hold fast in mine roof



To:
Mr. Charles Maynard
Mine #3

Chuck:

This is the shell I talked to you about last week at the mine. Roof bolting is right up O-B's alley... they pioneered the use of expansion units... probably know more about them than anyone in the field. I suggest you get in touch with their local sales engineer. I've found Ohio Brass people are glad to work right with you in the mine.

Regards:
Jack

Ohio Brass 4-Way Expanding Anchors hold in both soft shale and hard rock

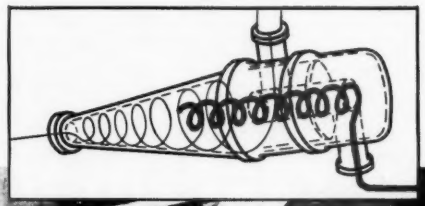
- **GO UP FAST** . . . 4-way expansion begins with the first turn of the wrench.
- **DEVELOP TOP HOLDING POWER** with easy wrenching effort . . . 150 "foot pounds" of torque gives bolt tensions of 9000 pounds.
- **WORK IN CLOSE QUARTERS** . . . O-B engineers developed these anchors underground. Personal knowledge of mining problems enabled them to design units that are especially suited to your needs.
- **GET SERVICE** for your roof bolting problems . . . see your local Ohio Brass engineering representative or write Ohio Brass Company, Mansfield, Ohio.

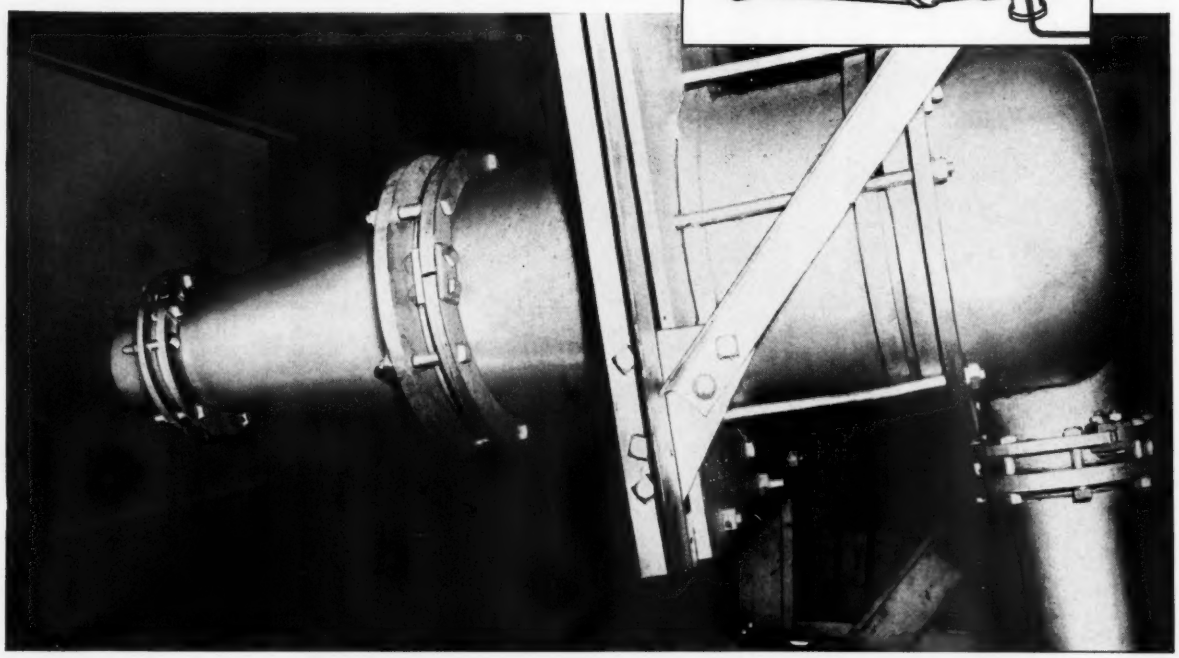
O-B Bail Type Expansion Shell and Plug

Ohio Brass OB HOLAN

EXPANSION SHELLS AND PLUGS • LINE MATERIALS • SAFETY AND CONTROL EQUIPMENT • ELECTRIC HAULAGE MATERIALS

NOW IN OPERATION IN THE U.S.A.





The Dutch State Mines

HEAVY MEDIUM CYCLONE WASHER

A new era in fine coal cleaning in the United States has been inaugurated with installations by Roberts & Schaefer of the Dutch State Mines Heavy Medium Cyclone Washing System.

The successful performance of the Heavy Medium Cyclone Washing System during the first few months of operation in this country confirms previous experience of 40 plants in 15 countries.

It cleans fine coal cleaner than any other cleaning system. It substantially increases recovery of fine coal. It enables coal operators to upgrade coal quality to meet premium market requirements.

If you are considering a new fine coal cleaning plant, or rehabilitation of your present facilities, get full information about the Dutch State Mines Heavy Medium Cyclone Washing System. It is available in this country exclusively from Roberts & Schaefer.

In the engineering and construction of Heavy Medium Cyclone Washing Plants in the United States, Roberts & Schaefer has the unique advantage of the collaboration of the Dutch State Mines engineering organization with its technical knowledge and experience with many successfully operating installations around the world.

ENGINEERS & CONTRACTORS

ROBERTS & SCHAEFER Company

201 NORTH WELLS STREET, CHICAGO 6, ILLINOIS

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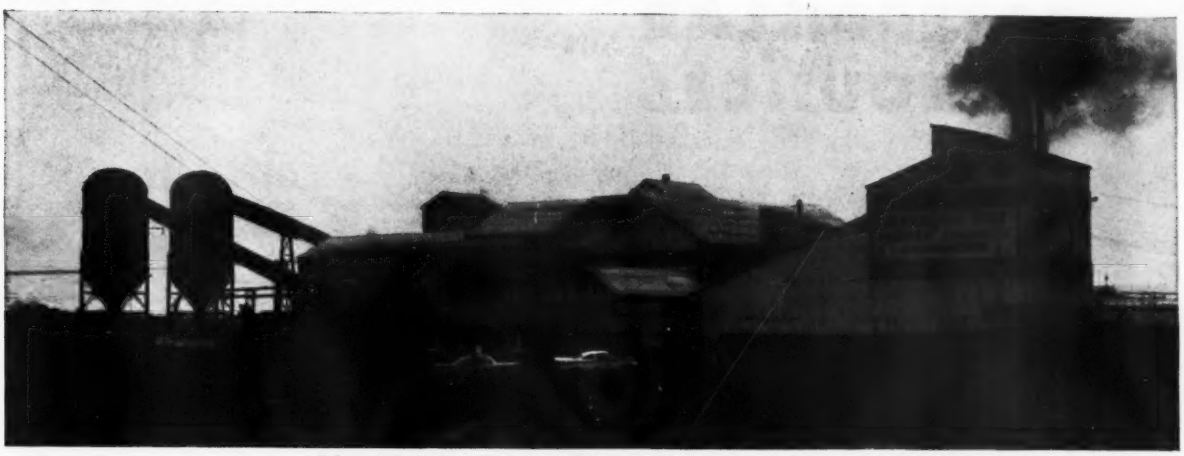
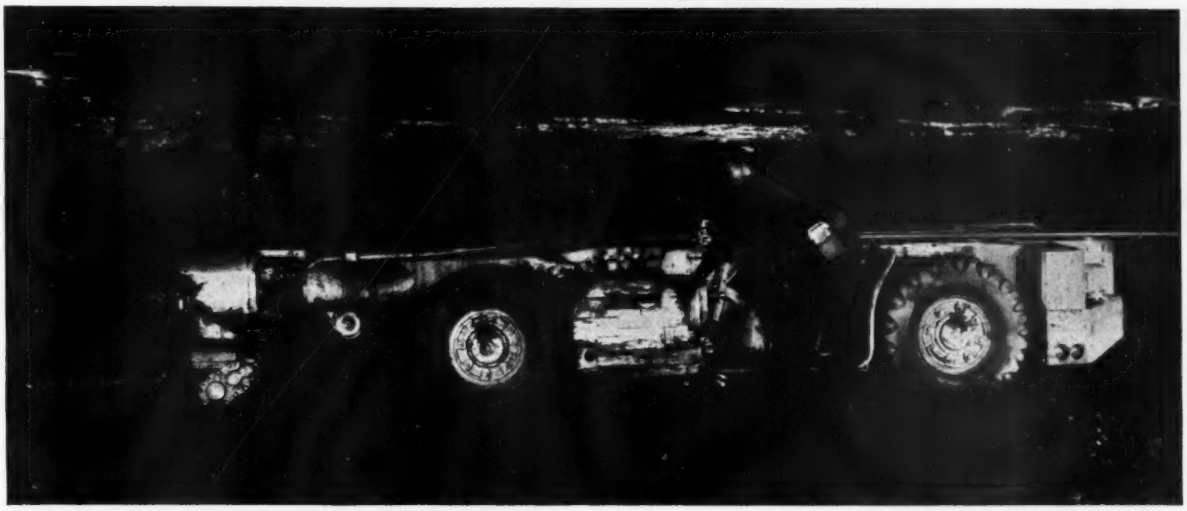
DIVISION OF THOMPSON-STARRETT COMPANY, INC.



Minnehaha Mine averaged 2700 tons of raw coal per day with two units of Jeffrey equipment working two shifts per day over a period of 22 months.

"Performance miraculous; costs reasonable" with conventional Jeffrey units at Minnehaha



Jeffrey 70-UR Cutting Machine.

Impressive results with Jeffrey equipment—drilling machines, shuttle cars, loading machines, cutting machines—are reported by the Minnehaha Mine of Fairview Collieries Corp., Sullivan, Ind. Management states that maintenance costs have been exceptionally low—and performance way beyond expectation.

SYSTEM PLANNING—The wide range of Jeffrey equipment in use was chosen on recommendations of an experienced Jeffrey sales engineer. While each unit is a solid performer itself, it takes experience to match and integrate the various pieces of equipment to give top performance of the whole mining system. Jeffrey analyzes the complete job—and comes up with recommendations to help you realize low-cost production.

ONE-STOP SERVICE—Standardizing on Jeffrey equipment streamlines maintenance and ordering of renewal parts, too. Minnehaha gets topnotch service from the Jeffrey warehouse in Evansville. Here, replacement parts are stocked for immediate delivery.

Use the Jeffrey system-planning approach —you'll find it pays off. The Jeffrey Manufacturing Company, 958 North Fourth Street, Columbus 16, Ohio.

JEFFREY

MINING • CONVEYING • PROCESSING EQUIPMENT ... TRANSMISSION MACHINERY ... CONTRACT MANUFACTURING

CATERPILLAR ANNOUNCES 2 NEW TRAXCAVATORS

with Power Shift Transmission and Live Action Hydraulics

There is a way to beat higher costs—and that's with increased production. For tractor-loader jobs, here's your answer in the new Cat Series H 977 and 955 Traxcavators. Designed to set a pace far faster than the models they replace (and other makes of comparable size), they're milestones in tractor-loader progress. With power shift transmission and Live Action Hydraulics, they're *the loaders that never stop.* Get the facts about them from your Caterpillar Dealer. Ask for a demonstration, too. See for yourself how they set new production figures on the toughest kind of job.

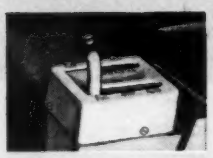
Caterpillar Tractor Co., General Offices, Peoria, Illinois, U.S.A.

CATERPILLAR

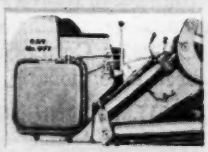
Caterpillar, Cat and Traxcavator are Registered Trademarks of Caterpillar Tractor Co.

TRAXCAVATORS ARE MAKING OTHER LOADERS OBSOLETE

NEW FEATURES SPEED LOADING, LIFTING, HAULING, DUMPING . . . THE FULL CYCLE



NEW POWER SHIFT TRANSMISSION. One lever—that's right, one lever gives split-second changes in speed or direction to slash cycle times and increase operator efficiency.



NEW LIVE ACTION HYDRAULICS. Provide faster lifting speed and greater lifting capacity without robbing power from the tracks.

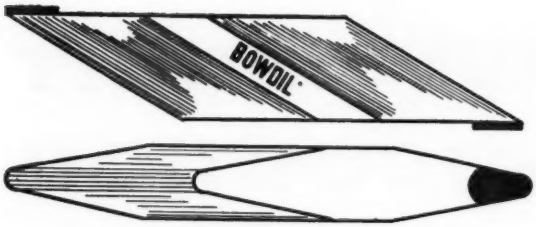
MORE HP WITH NEW CAT TURBOCHARGED ENGINE. Up 50% on the 977H—up 43% on the 955H.

NEW INCREASED BUCKET CAPACITY. An 11% increase on the 977H—a 16.6% increase on the 955H.

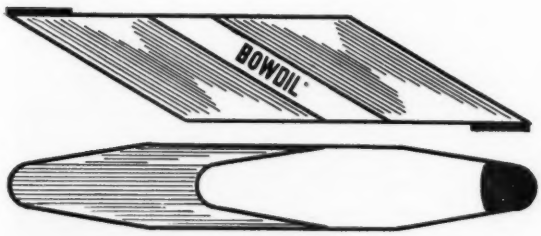
NEW HEAVY-DUTY UNDERCARRIAGE. Larger, stronger track components also increase stability . . . lifetime lubricated rollers with exclusive floating ring seals need no servicing.

MORE HIGH-PRODUCTION FEATURES. New gasoline starting engine . . . new dry-type air cleaner that cuts maintenance time as much as 75%. Plus such retained features as 40° bucket tilt back . . . automatic bucket positioners and kick out . . . hydraulic track adjusters.

QUICK-CHANGE ATTACHMENTS. Multiply the usefulness of these machines. Attachments available include the Side Dump Bucket, Rock Bucket, Quarry Bucket, Bulldozer, Ripper and Log and Lumber Forks.



No. 1-19
Regular Diamond Bit BOROD TIPPED. Designed for medium cutting conditions, they save power, produce coarse cuttings.



No. 1-20
Heavy Diamond Bit BOROD TIPPED. Designed for severe cutting conditions, such as iron pyrites and rock.

introducing...

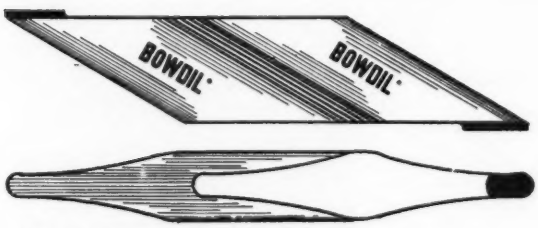
BOROD TIPPED
BOWDIL BITS

4 MOST POPULAR STYLES

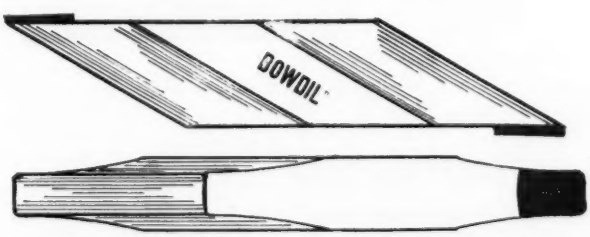
These various types are designed for specific requirements. After the BOROD is placed on the Special Alloy Steel body it is heat-treated to the most serviceable temper.

We are happy to offer these quality bits for your individual needs and cutting conditions.

TO HELP YOU RE-ORDER, PLACE YOUR TYPE BIT ON THESE ACTUAL SIZE DRAWINGS



No. 1-28
Regular Concave Bit BOROD TIPPED. Designed for maximum power savings. Concave shape automatically maintains side clearance. (Patented feature.)



No. 1-29N4
Heavy Duty Concave Bit BOROD TIPPED. Designed for very severest service.

ORDER BY NUMBER

THE BOWDIL COMPANY • CANTON 7, OHIO

Gentlemen: Rush us

_____ NO. _____ BITS
(Quantity)

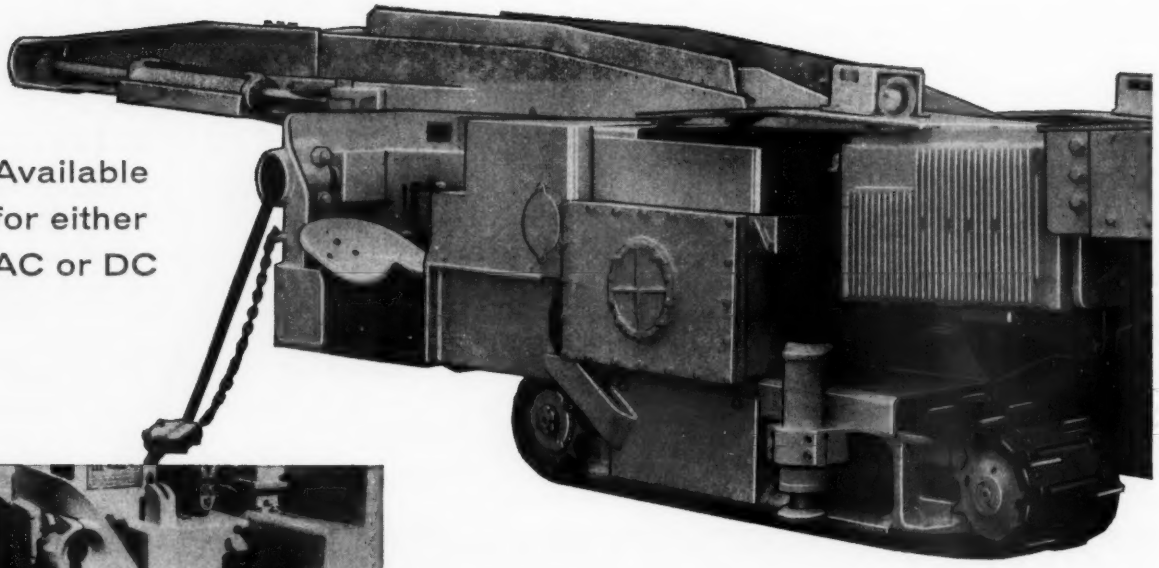
Name _____
(PLEASE PRINT)

Address _____

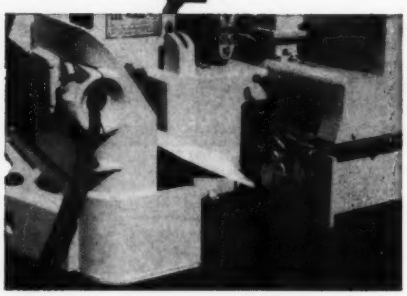
City _____ State _____

The **BOWDIL COMPANY**
CANTON 1, OHIO

LIGHTWEIGHT COST *plus* HEAVYWEIGHT *equals* PRODUCTION



Available for either AC or DC



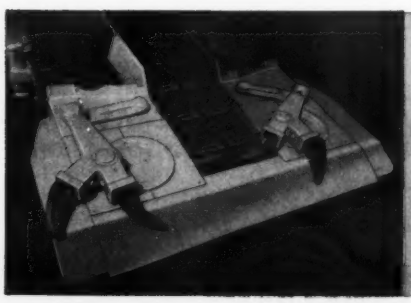
OPERATOR'S PLATFORM

Compact and convenient hydraulic and electrical controls are within easy reach of the operator. Throttle valve precisely controls the speed of all hydraulic operations as well as providing "deadman" control.

16″ WIDE CRAWLER

The new crawler with heavy-duty gearing can operate the miner on steep grades and also float on soft bottom.

Less than 25 P.S.I. ground pressure.

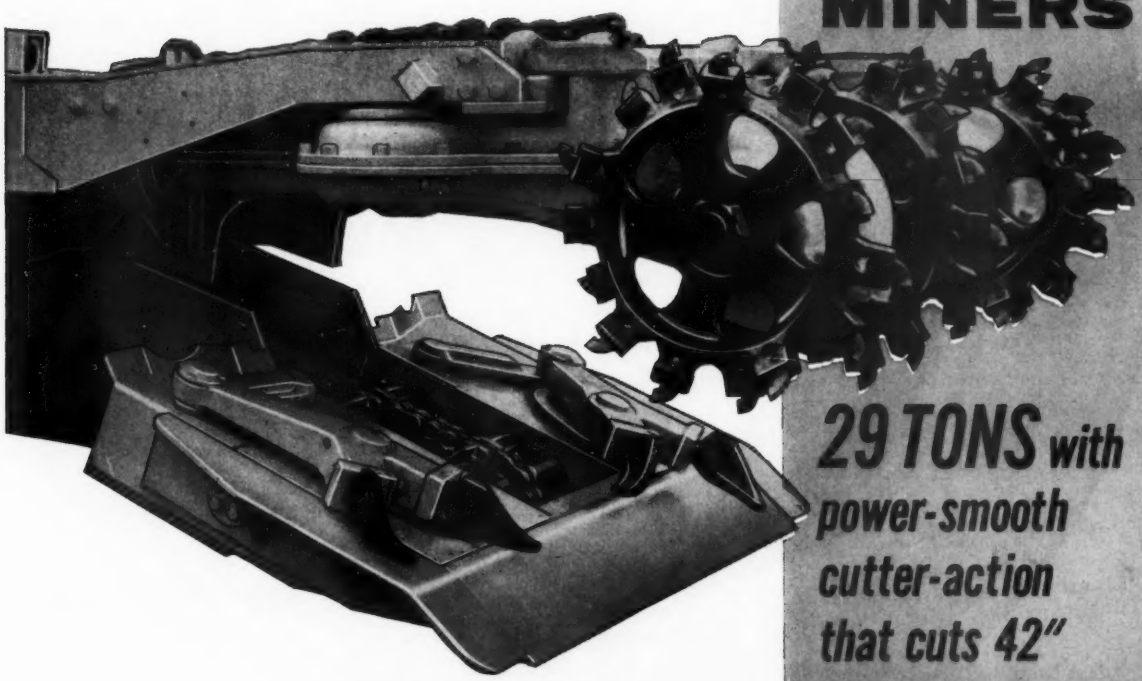


GATHERING HEAD

The exclusive "dual gathering arms" provide maximum reach and much better flow to the conveyor.

PERFORMANCE PUNCH

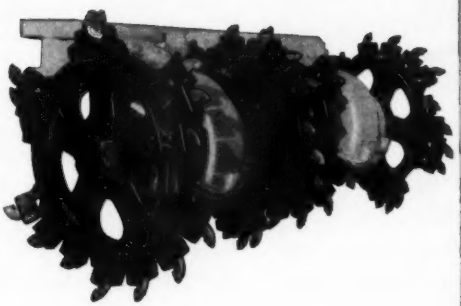
Lee-Norse CM38 and CM48 MINERS



29 TONS with power-smooth cutter-action that cuts 42" to 120" seams and gathers loads as fast as they are cut

CUTTING HEADS

New "Rap-Lok*" Cutter Bits, spaced evenly around cutter rim, provides smooth, vibrationless performance. Extremely quick "bit change"—no set screws—long bit life.



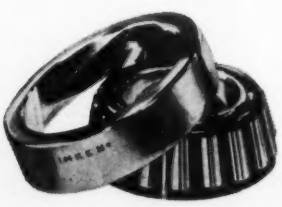
*Trade Mark of The Cincinnati Mine Machinery Co.

Lee-Norse Company
CHARLEROI, PENNA.
Specialists in Coal Mining Equipment

Coal high or low?... Lee-Norse MINERS keep production on the go!

THERE are two big reasons why the trade-mark "Timken" guarantees top bearing value. 1) It assures you of uniform high quality and performance. From the steel right through to final inspection, Timken® bearings are made to the industry's most exacting specifications. 2) You're assured of the finest bearing service available.

"Timken" is the registered trade-mark that identifies tapered roller bearings, fine alloy steel and removable rock bits made by The Timken Roller Bearing Company. For your guarantee of value, specify "Timken". The Timken Roller Bearing Company, Canton 6, Ohio. Cable: "TIMROSCO". Canadian Division: Canadian Timken, St. Thomas, Ontario.



Industry rolls on

TIMKEN®

tapered roller bearings

NOW... R/M's NEW "Coalmover" CONVEYOR BELT

SETS THE STANDARD FOR COAL MINE PERFORMANCE!

HAULS MORE COAL! LASTS LONGER! COSTS LESS!

Introducing the latest product of R/M rubber research and development for the coal industry. R/M Coalmover—new conveyor belt designed and engineered for underground coal mining . . . job-proven in all types of underground conveyors. Compare these advantages with any other belt on the market—you get them *all only* with R/M Coalmover!

Light in Weight—easy to handle and re-spool for advancing and retreating

Superior Fastener Holding Ability—holds *all* makes of fasteners *longer*, reduces maintenance costs

Solid Edge Construction—scuff resistant, will not fray or fan out

Fire Resistant Cover Top *and* Bottom—can haul on either side

Exceptional Pulley Grip—permits operation at lower tension *without* slip

High Coefficient of Friction—no slippage or spillage as with plastic covered belts

Maximum Rip Resistance—service life protected against wear, tear, gouging and abrasion

Low Stretch—requires minimum take-up adjustment

Rugged Impact Resistance *plus* Exceptional Flexibility—lasts longer over reverse bend or snub pulleys

Troughs Easily, Trains Naturally—haul *full* loads even in low-head room installations

Is not thermoplastic—does not stiffen up at low temperatures, is quiet running

FIRE RESISTANT!

Like all Manhattan Underground Conveyor Belts, new R/M Coalmover is mildew-proof, moisture resistant—and certified with Bureau of Mines' acceptance designation: "Fire-Resistant, U. S. B. M. No. 28-10."

COALMOVER IS NOT A PLASTIC COVERED BELT. ASK YOUR REPRESENTATIVE FOR DETAILS ABOUT R/M's NEW CONSTRUCTION ENGINEERED TO GIVE YOU "MORE USE PER DOLLAR" IN YOUR MINING OPERATIONS.

RM-1021

RAYBESTOS-MANHATTAN, INC.

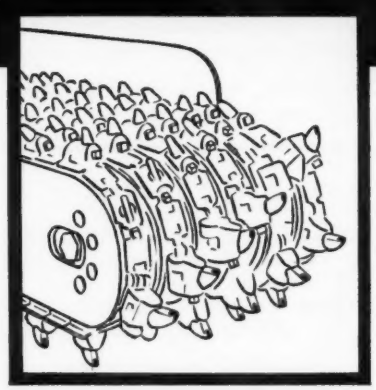
MANHATTAN RUBBER DIVISION, PASSAIC, NEW JERSEY

RM

ENGINEERED RUBBER PRODUCTS . . . MORE USE PER DOLLAR

V-R RED BITS

Stronger Chain Cutter Bit for Continuous Miners and Universal Machines



Stronger . . . pocket design provides extra brazing area and additional steel on the sides imparts more strength.

Reduced Drag . . . cut-away shape reduces both drag and regrinding time.

Less Breakage . . . solid shank and wide collar seats the bit rigidly and prevents wobbling and breakage.

Quality Carbides . . . plus shanks engineered for the specific job give you better service, increased production and more profit per ton.

Send for Catalog VR-488 for complete details

CREATING THE METALS THAT SHAPE THE FUTURE

VASCOLOY-RAMET

872 MARKET STREET • WAUKEGAN, ILLINOIS

M-784

High Grade Results in Low Grade Ore

Two Marion 4161 machines are helping to point the way to high grade recovery of low grade ore in the Lake Superior region.

The diet of these machines is a hard, abrasive Jasper formation weighing 2.6 tons per yard. The Marions work on 40 foot benches in blasted pits ranging to 100 foot depths which may eventually reach 500 feet.

Let Marion mining machines, in a broad range of sizes and types, help you get high grade, high profit results.

CONSULT MARION MINING SPECIALISTS
for lowest costs on your property!

MARION POWER SHOVEL COMPANY - MARION, OHIO, U.S.A.
A Division of Universal Marion Corporation

DRILLING ★ INDUSTRIAL ★ AIRCRAFT ★ MINING ★ LOGGING ★ ELEVATOR ★ MARINE ★ CONSTRUCTION ★

MACWHYTE WIRE ROPE

THERE'S A REASON WHY IN WHYTE STRAND SHOVEL ROPES!

For your mining operation, there are many reasons why Whyte Strand is the best wire rope you can use on your shovels. Here are just a few:

- Every foot of wire in Whyte Strand is specially drawn by Macwhyte in their own wire mill.
- Product engineers determine the exact makeup of each rope to assure correct size, strength, and flexibility to meet your requirements.
- Special Macwhyte lubricants are used in accordance with the needs of the equipment or the type of service in which the rope will be used.
- Entire wire and rope mill operations are concentrated on the making of one product . . . *wire rope!*

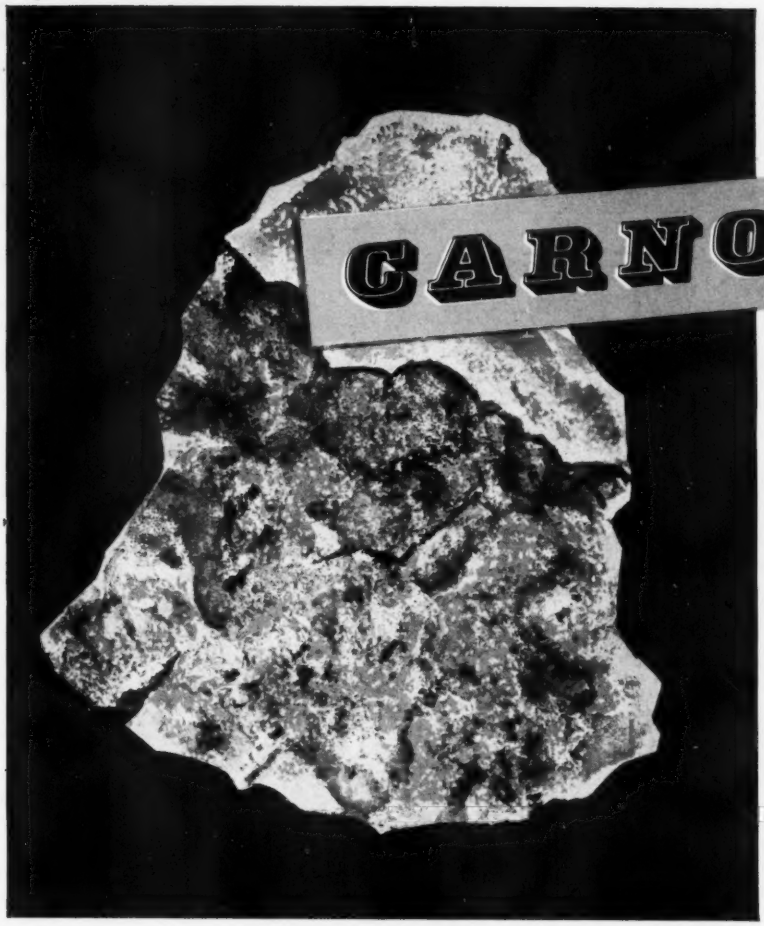
But the proof of the pudding is in the using — and here's where Whyte Strand shines. You can spend all kinds of money, but you can't buy a better rope for your shovels than Whyte Strand . . . nor one that will give better service, with less trouble.

Whyte Strand shovel ropes are made in two strengths — Monarch Whyte Strand Improved Plow Steel and PREmium Whyte Strand Extra Improved Plow Steel — both are listed in bulletin No. 6025.

Ask for this new bulletin which gives complete listings of all Whyte Strand wire rope. 213-B

MACWHYTE Wire Rope COMPANY

2900 Fourteenth Avenue, Kenosha, Wisconsin, U. S. A. | Wire Rope • Slings • Cable Assemblies



CARNOTITE

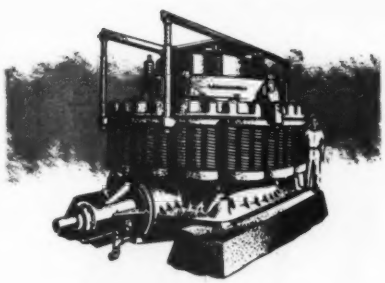
...storehouse of Uranium

A complex mineral containing uranium, vanadium and radium, Carnotite is usually recognized by its yellow mineral color and nonmetallic luster. First discovered in Colorado, it was taken to France for analysis and there named for the French mining engineer and chemist, Marie-Adolphe Carnot.

Now one of the most significant ores of uranium to be found in the United States, it is used exclusively to meet the demand for this important rare element.

Because of the low mineral content of the ore, extraction of uranium requires efficient reduction in early processing stages. Exceptionally well suited for this work are Symons® Cone Crushers, which assure fine reduction with high capacity output. These are reasons why producers of uranium all over the world depend on Symons Cone Crushers to produce big tonnages of uniformly crushed material at low cost.

NORDBERG MFG. CO., Milwaukee 1, Wisconsin



SYMONS CONE CRUSHERS
... The machines that revolutionized crushing practice... **are built in a wide range of sizes, for capacities to over 900 tons per hour. Write for descriptive literature.**

When there's roof to be bolted... Bethlehem contact men help you test and install

Experienced Bethlehem contact men are ready—anytime—to help you with the original installation and testing of Bethlehem mine roof bolts and accessories.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

for strength
... economy
... versatility

Steel

BETHLEHEM STEEL

THE RELIANCE SUPER 'T'

A New Kind of D-c. Motor With DYNAMIC RESPONSE

Here is a motor built to make maximum use of d-c. flexibility. The Super 'T' puts Dynamic Response into starts, stops, and speed changes. Dynamic Response gives you a 50% increase in torque and a 50% decrease in reaction time.

This top performance is due to advanced balanced design. Lighter, small diameter armatures cut mechanical inertia 50%. Superior Class B insulation, gives extended life even at temperatures as great as 130°C.

Top grade insulation plus engineered ventilation lets the Super 'T' take tremendous overloads. In fact, the Super 'T' can develop double normal horsepower during starts, stops, and speed changes.

The Super 'T' is a compact power package, designed inside and out for tough industrial service. From appearance to performance, the Reliance Super 'T' with Dynamic Response is today's most modern industrial motor.

C-1577

Product of the combined resources of Reliance Electric and Engineering Company and its Master and Reeves Divisions

RELIANCE ELECTRIC AND ENGINEERING CO.

Dept. 65A, CLEVELAND 17, OHIO
Canadian Division: Toronto, Ontario
Sales Offices and Distributors in Principal Cities

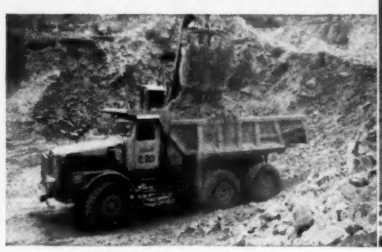
Duty Master A-c. Motors, Master Gearmotors, Reeves Drives, V★S Drives, Super 'T' D-c. Motors, Generators, Controls and Engineered Drive Systems.

If you use rear-dump haulers

Backed by better than 25 years of specialized experience in building off-highway earthmoving equipment exclusively, Euclid's modern rear-dump line incorporates advanced engineering that is a result of unmatched field experience. From the 10-ton Model R-10 to the big 55-ton "Euc" with two engines and a total of 672 h.p., Euclid Rear-Dumps are job proved to meet today's requirements for big performance. This greater dimension... in range of capacities, in choice of engines, transmissions and tire sizes, and in type of hauler... and in parts and service facilities of a world-wide dealer organization, too... can mean lower hauling costs and more work-ability on every one of your rear-dump jobs.

Have the Euclid dealer in your area give you facts and figures to compare with your own hauling costs... you'll find Euclid's greater dimension pays off in a better return on your investment. EUCLID Division of General Motors • Cleveland 17, Ohio

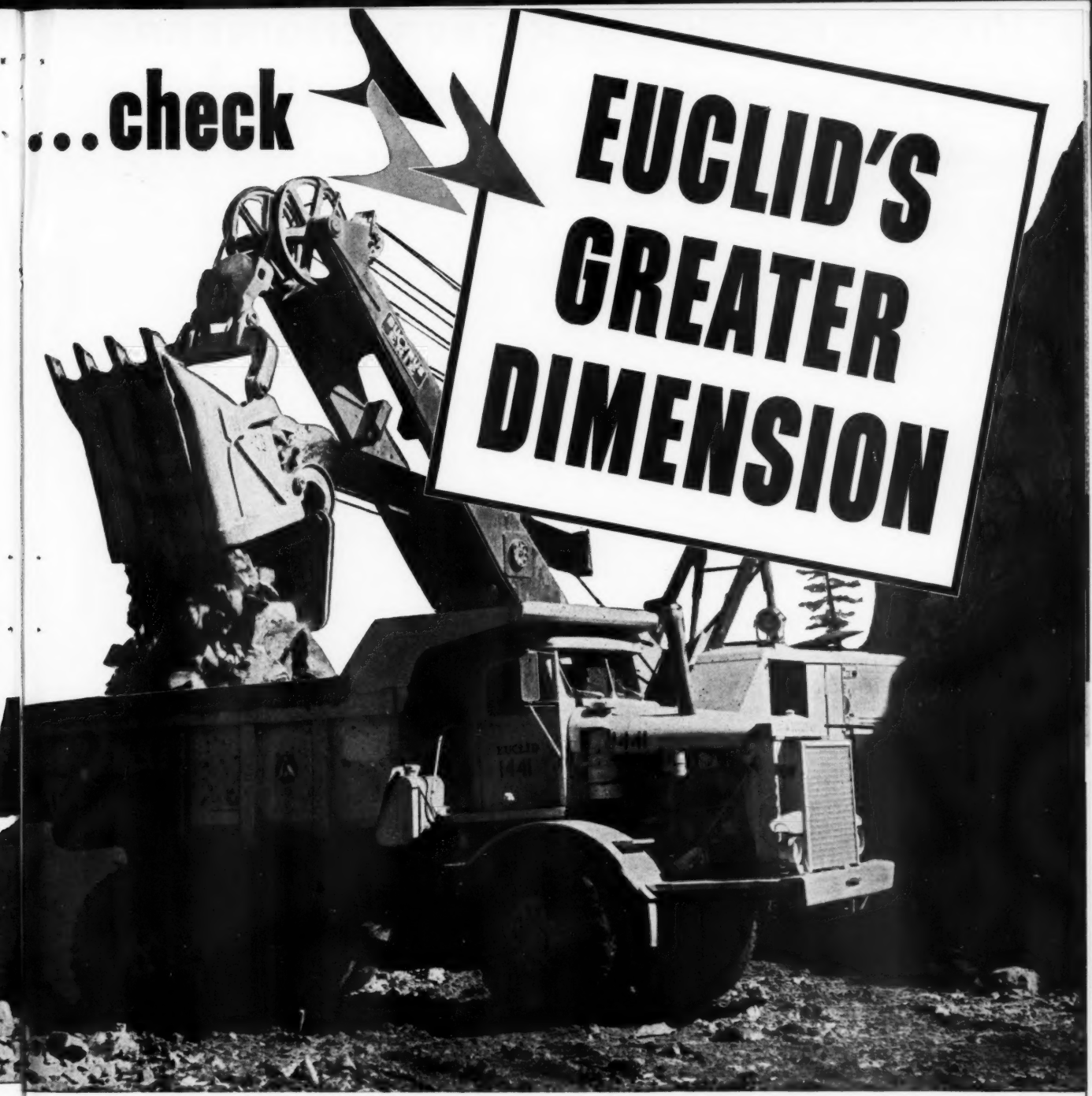
Payload capacities of 10, 15, 18, 22, 27, 40 and 55 tons... also semi-trailer models of 12, 22, 35 and 50 ton capacity.



When you compare Rear-Dump Haulers, check these 7 points...

- is maker experienced in the field... known for building a dependable, well-engineered product?
- does machine have required performance ability needed... capacity and speed for high production work, power and traction for rough going and steep grades?
- well-balanced for size of loading equipment... hoppers and controlled dumping needs?
- is there good parts and service availability... at both manufacturer and dealer level?
- are maintenance manuals, parts books and service literature complete... is machine designed for easy servicing?
- is machine easy to operate... convenient controls... good visibility... operator comfortable so that efficiency is maintained for entire shift?
- can required production be maintained at low cost... construction rugged enough to withstand heavy service with minimum maintenance?

Euclid Rear-Dumps meet every one of these important requirements... and more!



BIG POWER . . . BIG CAPACITY . . . BIG PERFORMANCE

Model R-27 has heaped capacity of 26½ yds. . . . rated payload is 54,000 lbs. . . . available with Cummins 335 h.p. or GM 336 h.p. engine . . . 4-speed Torqmatic Drive with converter lock-up and Torqmatic Brake . . . dual hydraulic booster steering . . . 18.00 x 25 tires on all wheels . . . rugged body with twin hoists . . . top speed with full payload, 34 mph. . . . available in two body types, standard for all-around use and quarry for hauling big rock.

ENGINEERED FOR EASY SERVICING

Like other Euclids, the R-27 is of simple, rugged design for years of dependable performance at minimum maintenance cost. When repair or replacement of major components is necessary, service-minded engineering saves time and money, too. For example, a transmission can be removed and replaced in just one-eighth the time required for the same work on a competitive hauler of the same capacity . . . engine replacement takes only one-half as many man-hours.

GM GENERAL MOTORS EUCLID

EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

Pre-Engineering by **KAISER ENGINEERS** answers basic plant expansion questions...

Raw Materials? Your final decision to expand or build results from a series of important individual decisions. Raw material availability is one of them. Independent analysis of all aspects of your proposed program is the *Pre-Engineering* service offered by Kaiser Engineers. In addition, KE is an experienced designer and builder of all types of facilities for the Minerals industry. From Pre-Engineering through design and construction Kaiser Engineers provides complete one-company service and ingenuity based on years of experience.

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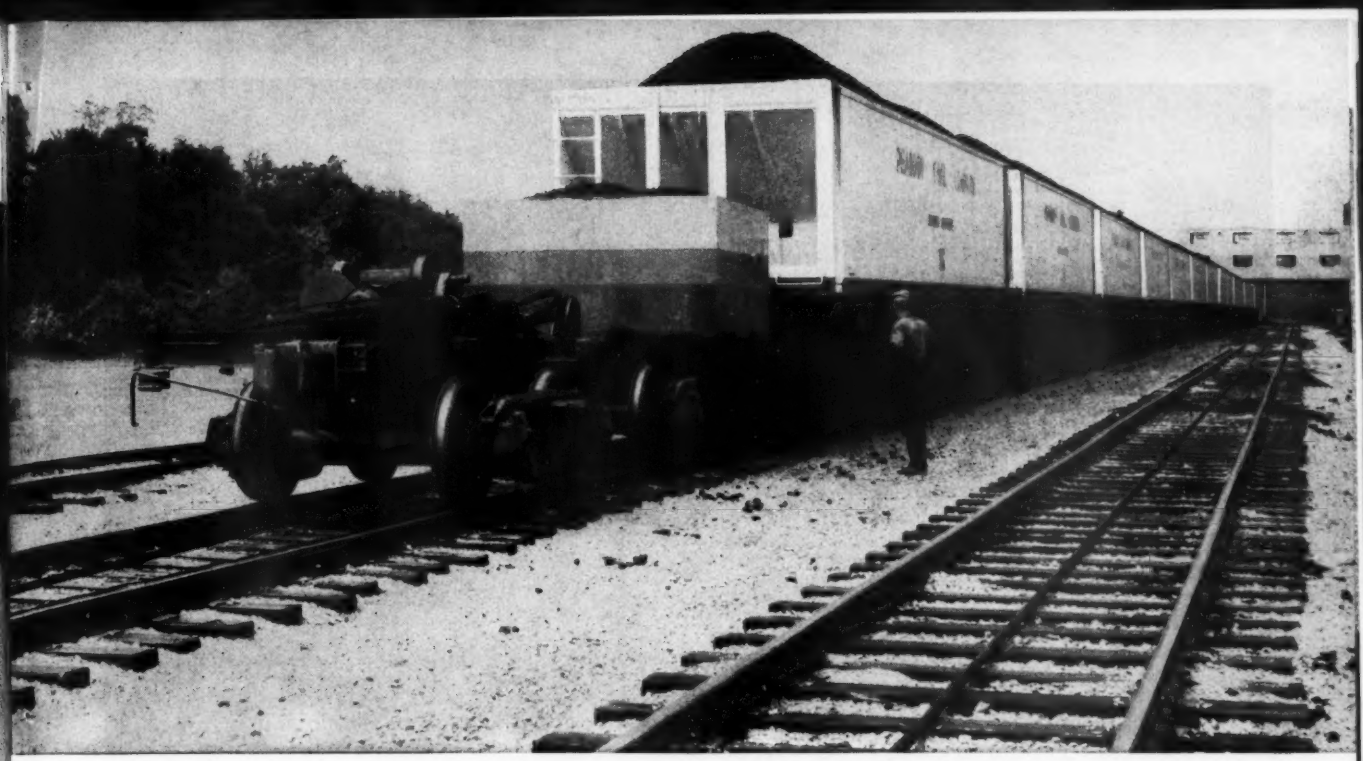

Car haulage system at River Queen Mine handles 15 cars of coal.

1,875 tons moved with one USS Tiger Brand Wire Rope

This automatic car moving equipment at the Peabody Coal Company River Queen Mine in Western Kentucky near Central City is rigged with 8,246 feet of 1¾-inch diameter USS Tiger Brand Wire Rope. It hauls 15 cars per trip with a total weight of 1,875 tons and could handle even greater loads. The system operates four 15-car trips per shift, two shifts per day.

The transmission rope in this service takes quite a beating. Starting loads get heavier as each car is filled. Bending stresses are high and the rope is, at times, subjected to severe abrasion. To meet these conditions, they use a strong, tough Monitor steel rope. Construction is 6 x 37, Excellay Preformed with fiber core.

Why USS Tiger Brand is your best buy. Tiger Brand Wire Rope is designed by one of the country's most capable staffs of wire rope engineers. It is made by a company that maintains the most complete research and manufacturing facilities in the steel industry. When you buy Tiger Brand you get the *right* rope for the job. And your job is only a phone call away from experienced American Steel & Wire field service representatives.

For more information, write American Steel & Wire, 614 Superior Avenue, N.W., Cleveland 13, Ohio, or contact your nearest Tiger Brand Wire Rope distributor.

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USS

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
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Drive unit rigged with 1¾" diameter Tiger Brand Wire Rope designed for strength, flexibility and long wear.

Rugged Kennametal U3RA Cutter Bits installed in new type chains on a 1 JCM continuous miner. Close-up shows the strong shank design.

How do YOU compare bits?

On the basis of . . . Bit life · Tonnage · Bit cost per ton?

KENNAMETAL BITS EXCEL ON ALL THREE COUNTS

At this West Virginia mine, bit costs averaged 5½ cents a ton, using standard carbide bits. Irregular occurrence of sulphur lenses and balls in the Pittsburgh No. 8 Seam sometimes jumped the average to 9 cents, with some sections running up to 67 cents. Tip failures occurred more often than in normal cutting, but breakage of the ½″ x 1″ shank was the big problem.

Switching to lower cost steel bits with hardfaced tips lowered bit costs considerably. But it also lowered production.

Kennametal U3RA Bits not only reduced shank breakage, but tip failures as well. The average bit cost dropped from 9 to 7 cents a ton . . . and production in heavy sulphur sections more than doubled.

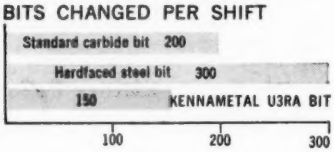
You can't pick good bits by appearance or price tags. Let the Kennametal difference show up in performance at *your* mine. Your Kennametal Representative will help you select and actually test Kennametal Bits in your mine. Call him, or contact us direct. KENNAMETAL INC., Mining Tool Division, Bedford, Pa. 97257

- Consistently high quality keeps Kennametal bits in service longer . . . resulting in fewer bit changes and more operating time at the face.
- Free-cutting design of Kennametal bits draws less power, permits faster cutting, maximum production, less maintenance.
- Every Kennametal bit is backed by 21 years of leadership in tungsten carbide tooling, including the development of the first carbide cutter bits for the American mining industry.
- Nineteen full-time Kennametal Representatives and the Kennametal Distributors—leading mine supply companies, provide assistance in solving your cutting and drilling problems and supply the tools you need . . . when you need them.

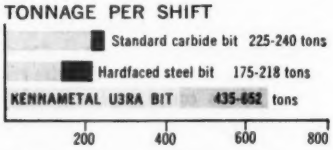
THE DIFFERENCE SHOWS UP IN PERFORMANCE

Different bits—same section—heavy sulphur

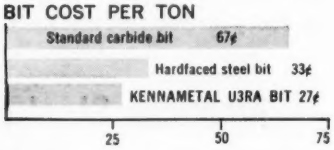
BITS CHANGED PER SHIFT



TONNAGE PER SHIFT



BIT COST PER TON



INDUSTRY AND KENNAMETAL
. . . Partners in Progress

Hon. Fred A. Seaton, Secretary of the Interior, addressed a capacity crowd at the Welcoming Luncheon

1960 AMC Coal Convention — Devotes Attention to Prime Industry Problems

WHEN the last bus pulled up in front of the Pittsburgh Hilton Hotel, returning from a trip to Hanna Coal Company's operations at Cadiz, Ohio, Thursday afternoon, May 12, it signaled the end of one of the finest meetings the American Mining Congress has ever had—its 1960 Coal Convention. One of the finest from every point of view—largest attendance, greatest interest in technical sessions and outstanding caliber of convention papers.

The meeting got off to a flying start with a reception Sunday afternoon May 8, to which all mining men and their ladies were invited. Some 2000 of them showed up to pay honor to convention officials and committee members.

Two convention features were scheduled Monday, May 9—the opening session with its panel on National Fuels Policy, and the Welcoming Luncheon featuring an address by the Honorable Fred A. Seaton, Secretary of the Interior. The address at the opening session, as well as the Secretary's remarks, which were also directed to a National Fuels Policy, are covered later in this report.

A special luncheon, Tuesday, May 10, was addressed by Richard Harkness, noted news commentator, who analyzed national and international events

The American Mining Congress was welcomed in its first visit to Pittsburgh since 1933 by Joseph M. Barr, Mayor of Pittsburgh, who pointed out the many changes in the city during the intervening period. Responding for the American Mining Congress were: Jesse F. Core, Vice President—Operations—Coal, U. S. Steel Corporation and Chairman of the AMC Coal Division; Robert H. Hughes, President, Clinchfield Coal Company and Chairman of the Program Committee; and Albert E. Seep, President, Mine & Smelter Supply Company, Chairman of the Manufacturers Division of the Mining Congress.

Tuesday Luncheon

A second luncheon was held Tuesday, May 10, with Albert E. Seep presiding. Charles O. Houston, Associate Curator, Division of Industrial Cooperation, Department of Arts and Manufacturers, The Smithsonian Institution, asked the cooperation of the industry in providing material of historical value for a permanent Hall of Coal, as well as a permanent Hall of Mining, in the new Museum of History and Technology now being constructed by the Smithsonian, stating, "nothing is too small, too large, too old or too insignificant."

The feature address at the luncheon was given by Richard Harkness, well known NBC news commentator, who enthralled his audience with an analysis of current national and international events.

Convention Sessions

Attendance at the various convention sessions was extremely heavy, with "standing room only" at several. This reflected the high quality of the papers, the recognized status of the speakers and the intense interest of the industry in improving efficiency in coal production and preparation.

Resumes of these papers, which will be published in forthcoming issues of *Mining Congress Journal*, appear on the following pages.

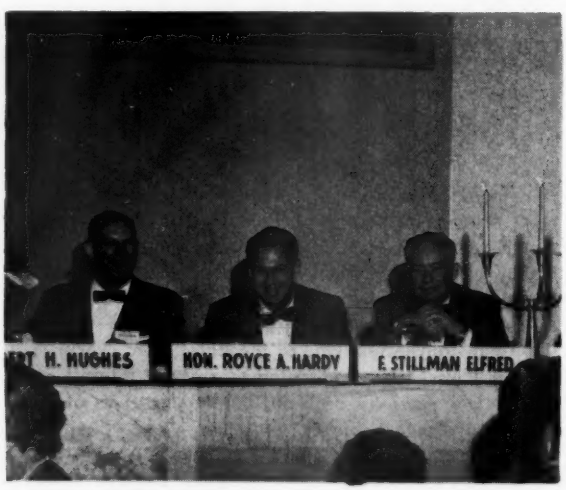
Manufacturers Division

Monday afternoon, May 9th, the Manufacturers Division held its regular meeting with Albert E. Seep, President, Mine & Smelter Supply Company presiding.

Julian Conover, AMC Executive Vice President, reported on the activities of the Division during the past year and discussed plans for the future. He also briefly reviewed the legislative situation in Washington as it affects the mining industry and manufacturers of mining equipment.

Three new members were elected to the Board of Governors and two old members resigned after many years of valuable service. Newly elected members were: E. M. Arentzen, Lee-Norse Company; C. E. Hammond, Westinghouse Electric Corporation, and Gordon MacVean, National Mine Service Company. Those who stepped down were George C. Holton, American Cyanamid Company and Fred O. See, Airdox Company.

At the meeting of the Board of Governors the following officers were elected to take office in 1961: Chair-



"Bob" Hughes, Program Committee chairman and Banquet toastmaster, had a good visit with Royce Hardy, Assistant Secretary of Interior, and "Stilly" Elfred, chairman of Peabody Coal Co.

man, D. E. Davidson, Link-Belt Company; First Vice Chairman, Austin Goodyear, Hewitt-Robins; Second Vice Chairman, J. H. Sanford, Ohio Brass Company, and Third Vice Chairman, Edward T. McNally, McNally-Pittsburg Manufacturing Company.

At a special meeting Tuesday afternoon, mining equipment manufacturers interested in the export market gathered to discuss this matter with representatives of the Department of Commerce. William E. Goodman, Board Chairman of Goodman Manufacturing Co., and Chairman of the Mining Machinery Industry Advisory Committee to the Department of Commerce, presided.

Industry and government leaders attending the convention included, (left to right) Julian Conover, executive vice president, American Mining Congress, Hon. Fred A. Seaton, Secretary of the Interior; Raymond E. Salvati, president, Island Creek Coal Co., president of the American Mining Congress, and Hon. John P. Saylor, U. S. Representative from Pennsylvania

National Fuels Policy

Secretary of the Interior Fred A. Seaton was chief speaker at Monday's Welcoming luncheon. He told the convention that the Government does not intend to restrict unnecessarily the right of American consumers to choose what type of fuels they may burn. At the same time, he added, the Government "has no intention of creating a set of conditions under which unlimited quantities of residual fuel oil can be imported and sold at distress prices."

The Cabinet officer predicted a bright future for the coal industry and commended the mining men for accomplishments in mine mechanization, labor-management relationships and safety.

"On the industry-wide organizational front, you have made it clear that you will continue to attack your problems in an aggressive manner. Indication of that is the work of such organizations as the American Mining Congress, which is our host today," Seaton said.

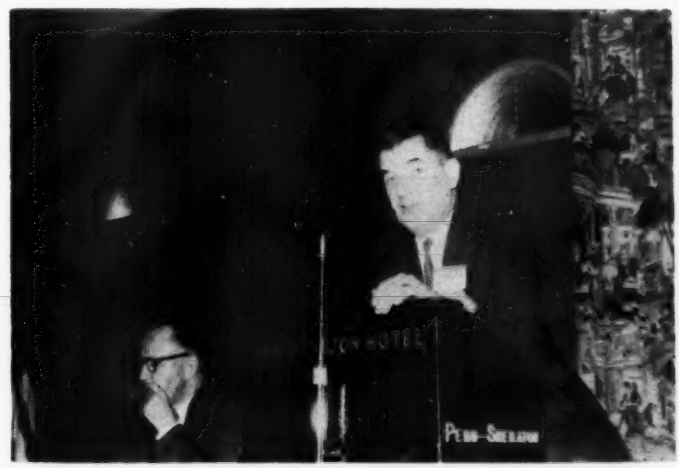
He said accelerated coal research is "an absolute necessity" and pledged the cooperation of the Department of Interior to this end.

"The Department now has underway comprehensive analyses of coal production, distribution and marketing methods, as well as projects ranging from geologic mapping to the development of new uses for coal. Much as we are doing in coal research, we want to do more. That is why I have repeatedly urged enactment of H. R. 3375, a bill now pending in the Congress, to provide the Secretary of the Interior with much needed authority to contract for coal research," the Secretary said.

"Admittedly, your industry has some very real problems," Seaton said. "Nevertheless coal, as a fuel and as a source material for many other uses, has a perhaps unlimited horizon of opportunities in the future. In the best tradition of economic competition, I am sure you recognize that fact and will seize those opportunities."

The Secretary was introduced by Raymond E. Salvati, AMC president.

The Convention's opening session Monday morning was devoted to National Fuels Policy and its participants included both industry and gov-



Jesse Core, chairman of the AMC Coal Division, discussed with the Manufacturers Division the need for continued close cooperation in solving future problems of attaining low-cost coal production. "Al" Seep, AMC Manufacturers Division chairman, presided at the meeting

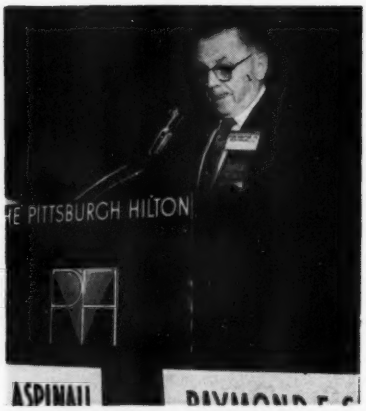
ernmental leaders. The aims of such a policy, according to Interior Assistant Secretary Royce A. Hardy, must be to assure an abundant supply of economical energy, foster vigorous competition among fuels, and set up a system of rules to insure fair competition. Rep. Wayne N. Aspinall of Colorado, chairman of the House Interior Committee, said chances were "favorable" for the adoption of a resolution at this session of Congress to establish a joint Congressional committee to investigate the need for such a policy. Rep. John P. Saylor of Pennsylvania urged a fuels study to eliminate

Hon. Royce A. Hardy, Assistant Secretary of the Interior, described the Administration's position on imports of residual oil

"the practice of dumping gas into industrial markets at whatever price is necessary to undersell coal. . ." Sen. Frank E. Moss of Utah also favored such a study.

Other participants were U. M. Staebler, assistant director of the division of reactor development, Atomic Energy Commission; R. A. Kampmeier, assistant manager of power, Tennessee Valley Authority; Stephen F. Dunn, president of the National Coal Association, and Joseph E. Moody, president of the National Coal Policy Conference. George H. Love, chairman of the board, Consolidation Coal Company, presided.

George H. Love, chairman of the board, Consolidation Coal Co., presided at the opening session on National Fuels Policy



Speakers at the opening session on National Fuels Policy included: (above) Rep. Wayne N. Aspinall of Colorado, Chairman of the House Interior Committee, and (below) Sen. Frank E. Moss of Utah

THIN SEAM MINING— NEEDS AND TRENDS

MONDAY afternoon a Thin Seam Mining session was held under the chairmanship of George E. Evans, Jr., president, Evans Elkhorn Coal Co., Inc. L. I. Cothern, director of engineering, Jewell Ridge Coal Corp., was vice chairman.

Conventional Mining in Thin Seams was the title of the first paper and was given by E. W. Potter, vice president & general manager, Royalty Smokeless Coal Co. He described the Medo No. 2 mine near Clifftop, W. Va., which is averaging 12.5 clean tons per man on the payroll in a 36-in. seam of coal. A conventional system of mechanical loading with shuttle cars is used. Of particular interest to the audience was Potter's description of some experimental work that the company is doing using a unit built basically from a 512 Goodman cutting machine but employing a boring type head which turns 180°. Based on experience with this machine, a new unit is being designed that will approach 300 tons per shift, using three to four face men per machine per place.

K. S. Hobbs, mine superintendent, Eastern Gas & Fuel Associates, described "Continuous Mining in Seams Less Than 38 In. Thick." He told how Stotesbury No. 10 mine of Eastern Gas & Fuel Associates at Helen, W. Va., has gone through the entire gamut of mechanization. The mine was opened with hand loading onto conveyors, progressed to conventional loading machines that were too high for the seam, then to low-type loaders, Piggyback conveyors, shuttle cars, and finally to continuous mining. Most of Hobbs' talk was devoted to the company's transition to continuous mining and the detailed planning and preparation that was necessary to insure success. Present production averages 2400 tpd, 40 percent of which is produced by the continuous mining machine. Conventional loaders with Piggyback conveyors and shuttle cars produce the remainder. Anticipated results have been more than fulfilled in the first eight months of service with productivity averaging 85 tons per face man per shift. The

complete paper is published in this issue of *Mining Congress Journal.*

In discussing "Equipment Needs and Trends for Thin Seam Mining," Neil Robinson of Robinson & Robinson, Charleston, W. Va., summarized advances in the technology of mining thin seams. Noting that the industry has done much to increase productivity of face labor, he said that it is now time to find ways and means of reducing non-productive labor, pointing out that several other industries have found it possible to save considerable sums in this area. Robinson concluded with an outline of anticipated equipment needs.

The final paper of this session was presented by Joseph J. Wallace, supervising mining methods research engineer, Mining & Preparation Section, U. S. Bureau of Mines. He described the Bureau's research in Hydraulic Coal Mining. Experiments were conducted in the hard bituminous Pittsburgh coal bed in a mine leased from the Rochester & Pittsburgh Coal Co., located in Indiana County, Pennsylvania. Construction and manipulation of the monitor were discussed, and the results of the tests with different size nozzles, pressures, and methods of mining were given. Wallace pointed out that experiments to date proved that the Pittsburgh bed can be mined hydraulically. When the optimum rate of mining is attained, Wallace concluded, the next stage will be to integrate hydraulic mining with hydraulc transportation.

STRIP MINING— RESEARCH AND MAINTENANCE PAY OFF

THE technical program was opened Monday afternoon with a session on Strip Mining and one on Thin Seam Mining. S. F. Sherwood, president, Stonefort Coal Mining Co., Inc., was chairman of the Strip Mining session. J. J. Huey, director of plant and equipment engineering, United Electric Coal Companies, served as vice chairman.

Dr. George B. Clark, chairman, department of mining engineering, University of Missouri, School of Mines & Metallurgy, Rolla, Mo., opened the session with a paper on Recent Developments in Blasting Overburden with Ammonium Nitrate. J. J. Yancik, research engineer, and R. F. Bruzewski, associate professor of mining engineering, Missouri School of Mines, assisted Dr. Clark in the preparation of the paper. Some observations resulting from the explosives research program at the Missouri School of Mines were pointed out as follows: (1) a positive means of mixing AN prills and fuel oil insures the greatest potential for obtaining the maximum available energy possible; (2) mixes made at least two hours before use obtain near maximum sensitivity; (3) a mixture of approximately 5.7 percent fuel oil is best; (4) small percentages of inert coatings lower the sensitivity of an oil mixture, but have little affect at the detonation velocity, and (5) increasing the density of AN-fuel oil explosives by tamping will increase the amount of available energy per foot of borehole provided the density is not increased to such an extent that the mixture is too sensitive.

Moving Overburden with Explosives, a paper by August Manifest, mine superintendent, Marco Coal Co., was presented by W. E. Coad, Jr., technical representative, Atlas Powder Co. The paper itself was published in full in the April issue of *Mining Congress Journal.*

E. R. Borcherdt, Borcherdt & Smith, San Francisco, Calif., then presented a paper on the Electric Wheel Drive. This application of electric motors to driving heavy trucks has excited interest among open pit miners everywhere. Borcherdt described a unit that was recently put into operation by the Anaconda Copper Co. in Butte, Mont., hauling 75-ton loads up a 15-percent grade at a speed of 12 mph. This duty has not required anything near the maximum available power—1600 hp, or 400 electric hp in each of four wheels.

The Borcherdt paper was discussed by Wayne McGlade, manager, product development, LeTourneau-Westinghouse Co., and Duane Lackey, development engineer, Unit Rig & Equipment Co.

* * *

The second Strip Mining session was held Tuesday afternoon with R. S. Walker, president, Bradford Coal Co., presiding as chairman. Vice chairman was A. E. Coddington, vice president, Carey, Baxter & Kennedy, Inc.

As in other phases of the mining industry, rapid technological progress has been made in the field of aerial mapping and photogrammetry, according to George L. Hess, sales engineer, Aero Service Corp., who discussed the Application of Electronics to Surveying and Mining. The development of an electronic instrument to measuring distances as great as 20 miles has considerably reduced the time needed to survey in rough country. Aerial photography has made easier the job of measuring quantities in stockpiles and the amount of earth moved at open pit operations. Perhaps the most dramatic electronic device employed in aerial mapping and exploration, Hess said, is a radar oriented instrument which guides survey planes over wilderness without ground reference stations, permitting surveys of areas previously considered too difficult, or downright impossible. The complete paper was published in the May issue of *Mining Congress Journal.*

Walter H. Schoewe, Division of Mineral Economics and Coal, State Geological Survey of Kansas, University of Kansas, analyzed six State acts requiring reclamation of spoil banks in a paper entitled "Land Reclamation". After discussing the various claims made by mandatory reclamation advocates, Schoewe contended that the spoil banks problem is greatly overemphasized as is indicated by the fact that spoil banks constitute less than one percent of the total land area in each coal mining State, whereas considerably more land is in the soil bank program in each State studied. Schoewe concluded by recommending the coal industries' early study of spoil bank problems so it can be prepared to meet and defend any attack from those favoring mandatory reclamation; and that coal operators, wherever possible, practice voluntarily some sort of reclamation of their own choosing in order to weaken the claims made by proponents of compulsory rehabilitation.

C. H. J. Breeding, field director, Ohio Reclamation Association, discussed the Schoewe paper with a description of Crown Vetch, a perennial legume with a heavy branching root system that is deeply penetrating, as

an aid to strip mine reclamation. A native of Europe, Crown Vetch's spectacular soil holding and ground covering properties make it of particular interest to the open pit mining industry, Breeding said.

The next two papers of the afternoon session were devoted to maintenance. A. F. Meger, assistant chief engineer, Wire Rope Division, John A. Roebling's Sons Corp., Division of Colorado Fuel & Iron Corp., discussed Wire Rope Maintenance, pointing out that a successful wire rope maintenance program requires careful analysis before plans can be formulated to correct existing problems. Accurate field records of rope damage can be invaluable, as can a program devoted to showing supply men how to properly store, handle and distribute wire rope. Many times, permanent damage results before the rope is ever put into service. Meger concluded by stating that a wire rope program is basically good maintenance procedure plus a generous application of common sense, and that such a program can save the mine operator many times its cost.

Maintenance of Rolling Stock was covered in a paper by Roy M. Leseney, mechanical superintendent, Truax-Traer Coal Co. Any strip mine maintenance program should start with well-shot highwalls and well-maintained haulage roads, Leseney said. He also pointed out that proper storage of electrical equipment is an effective means of prolonging the life of that equipment when it once gets into service. A properly designed and executed routine maintenance program is also of the utmost importance, as is a proper maintenance philosophy. Any maintenance program is lost without complete cooperation of supervisors, mechanics and operators, Leseney said, pointing out that supervisors must influence operators and mechanics in such a way as to make them maintenance minded.

The final paper on strip mining at the Convention was given by Charles Cooper, instructor in open pit mining, University of Pittsburgh, who covered the use of Bulldozers as a Supplemental Tool for Revolving Excavators in open pit mining operations. Using examples of various stripping traditions, Cooper showed that under many circumstances it is cheaper to move a portion of the overburden with bulldozers than with rotating equipment.

Speakers at the Coal Preparation session Tuesday morning, May 10. Standing: Dick Joslin, Clinchfield Coal Co.; Dave Werner, Pittsburgh Coal Co.; Frank Zachar, consulting engineer, and J. E. Ippoliti, Wilmot Engineering Co. Seated: Al Massmann, Peabody Coal Co., session vice chairman, and Bob Von Storch, U. S. Steel Corp., session chairman

COAL PREPARATION— AUTOMATION AND FINE COAL CLEANING

THE first of two coal preparation sessions was held Tuesday morning. R. M. Von Storch, general superintendent, coal mines and quarries, Columbia-Geneva Steel Div., U. S. Steel Corp., was chairman. He was assisted by vice chairman A. P. Massmann, preparation superintendent, Peabody Coal Co.

F. R. Zachar, mining engineer, Morgantown, W. Va., introduced his talk on Some Economic Aspects of Coal Preparation by pointing out that coal's largest customer, the electric utility industry, is beginning to switch its coal purchasing policy from buying coal on a strictly Btu basis to an appreciation of the reduced operating cost that can come with burning higher grade coal—which generally means increased preparation. He then went on to use specific examples to show how and where increased investment in coal preparation facilities will pay off.

Progress in Preparation Plant Automation was the subject of a paper by R. E. Joslin, manager, preparation department, Clinchfield Coal Co. Joslin described the Moss No. 3 preparation plant of Clinchfield Coal Co. and discussed the many labor saving devices which were included in the plant design. Centralized control of plant sections has contributed to a reduction in manpower, and he estimated that, with a car retarder system handling railroad cars to and from loading booms, 15 or more men per three-shift day have been saved. Joslin cautioned that automation is not possible without instrumentation and that serious consideration should be given to investment in this area.

L. A. Updegraff, project engineer, Bituminous Coal Research, Inc., Columbus, Ohio, discussed the Joslin paper and described a moisture meter that has been developed at Bituminous Coal Research. The unit is actually an instrument which measures the capacitance characteristics of a stream of coal—capacitance being related to the coal moisture.

Preparation Plant Maintenance was discussed by David G. Werner, main-

tenance engineer, Pittsburgh Coal Co. Stating that maintenance of a preparation plant is a two-dimensional problem—the plant must operate efficiently with a minimum number of delays, and with a reasonable cost—Werner described changes at a 240-tph fine coal cleaning plant which permitted the attainment of these objectives. In redesigning the plant four drag tanks, one distribution conveyor, one cyclone pump, four 14-in. cyclones, one spray pump and miscellaneous piping, brooms, valves, electric circuit breakers and controls were eliminated. As compared to its older counterpart, the new plant is practically maintenance free, requires less horsepower, and is almost foolproof against breakdowns, Werner stated.

J. E. Ippoliti, chief engineer, Wilmot Engineering Co., White Haven, Pa., covered What's New in Anthracite Preparation. He described a totally automatic density control robot for application on modern dense medium systems as the most important recent advance in anthracite preparation. Using radiation from Cesium 137, the unit measures current flowing through the dense medium circuit to determine the density of the medium. The sensing device has been connected to an automatic control which adds magnetite or water to maintain proper gravity. The full text of his paper appears in this issue of *Mining Congress Journal.*

Coal preparation was again the subject of a session Wednesday afternoon. W. D. Hamilton, vice president, Oglebay Norton Co., Cleveland, Ohio, was session chairman, and J. D. Snyder, chief engineer, Blue Diamond Coal Co., Knoxville, Tenn., was vice chairman.

The first paper of the afternoon was prepared by A. E. Copeland, assistant engineer, C. W. Porterfield, director of research-testing and sales liaison, and Guy N. Hanes, superintendent of preparation plants, Pocahontas Fuel Co. A discussion of Fine Coal Cleaning with Double-Deck Tables, the paper was presented by C. W. Porterfield, who discussed table capacity under various conditions; performance by various sizes, single-deck vs double-deck performance and required auxiliary equipment.

R. K. Bogert, Jr., president, Badger Coal Co., Inc., covered Fine Coal Cleaning with Feldspar jigs. Badger Coal is using a feldspar jig on ¼ in. by 0 coal, reducing ash from 12.51 percent in the feed to 8.71 percent—both on a dry basis. Recovery is 94.5 percent of theoretical.

Fine Coal Cleaning with Heavy Medium Cyclone was the title of a talk by J. P. Matoney, chief engineer, Heyl & Patterson, Inc. Matoney stated that when a heavy media is fed to a cyclone, gravity differentials are set up which vary from the air core to the cone wall and from the bottom of the vortex finder to the apex of the cone. Light elements in the feed float toward the core; heavy elements in the feed stay against the cone wall, or if caught in the central low gravity section of the cone, quickly sink away to the wall. The centrifugal effects within the rotating mass of media, water, and feed solids, tend to multiply the specific gravity differences and account for the amazingly sharp partition curves which are observed. He then went on to discuss test results with various types of media and various types of coal, concluding that in the future cyclone plants will predominate for difficult washing jobs, particularly where there is an excess of near gravity material; where the required washing gravity is low, and where the washing characteristics of the raw coal vary within wide limits.

The final coal preparation paper was prepared by Paul Levin, project engineer, Allen & Garcia Co., and was devoted to the Thermodynamics of Fine Coal Drying. In Levin's absence, the paper was read by D. H. Dowlin, also with Allen & Garcia. The paper was devoted to calculating the heat balance for various coal drying problems to make the mine operator aware of the many factors which determine the size and evaporating efficiency of his dryer. It was pointed out that, other things being equal, a high relative humidity of dryer exhaust gas will result in a high thermal efficiency in the drying process. On the other hand, with a high humidity exhaust, the dryer operates closer to the point of condensation in the exhaust ducts, and if condensation occurs, and is allowed to persist, the wet areas will accumulate dust which in time will completely choke the ducts and dust collectors and put the ducts out of service. Levin's paper was published in the April issue of *Mining Congress Journal.*

SAFETY—
PROGRESS CONTINUES

WILLIAM E. HESS, manager of mines, Jones & Laughlin Steel Corp., presided at the Tuesday morning session on Safety. Charles R. Waine, chief engineer, Olga Coal Co., served as vice chairman.

The first part of the morning was devoted to a panel discussion on progress in roof control. Control of mine roof is a problem that will always face underground miners; however, there have been several recent developments which promise additional valuable tools in controlling mine roof. The first panelist, D. F. Crickmer, chief engineer, Pocahontas Land Corp., devoted his talk to Roof Cementation. Pocahontas Land, a subsidiary of Norfolk & Western Railway Co., owns and controls some 400,000 acres of coal lands in three States—West Virginia, Kentucky and Virginia. Within these holdings, there are some areas of premium metallurgical coal which have near unmineable roof conditions. Being aware of this, in 1956 the company began investigations and experiments in possible methods of roof control by cementation through infusion of chemical compounds with adhesive and cohesive qualities into the mine roof. Results of these experiments have been encouraging.

Sonar Exploration of Roof Rocks was the title of the next paper. Coauthored by Dr. Charles E. Mongan, Jr., consulting physicist, and Thomas C. Miller, mining health and safety engineer, Roof Control Group, U. S. Bureau of Mines, the paper was presented by Miller. He described an investigation instituted by the Bureau to determine whether sonic techniques could be applied successfully to detect hidden uncomformities common in coal mine roof. Preliminary tests were made using layers of roof rock in the laboratory. To apply the experience thus obtained, a unit was designed and constructed for use underground. The apparatus employed two transducers which emit sonic energy (high-frequency vibrations) in the form of a beam somewhat like a searchlight. In

this case, one transducer served as a transmitter, the other as a receiver. They were mounted on a support frame which could be adjusted so that the transducers could be pressed against or coupled to the roof. The equipment was set up in the mine and photographs made of the outgoing and reflected pulses (echoes) on a Cathode Ray Oscilloscope. Later a borehole was made at the same location, so that the log of the borehole could be compared with the photograph of the returned signal. Miller concluded that both the theory and the actual experiments indicate the practicability of the method. However, he said, much lighter and more compact apparatus is desirable.

The last panelist, A. V. Gibson, division superintendent, New River & Pocahontas Land Co., took A Practical Look at Progress in Roof Control. He pointed out that mine management has moral and legal obligations to provide employes with means to protect themselves. Legally it must provide a plan and the necessary materials to comply with it. Morally it must do everything it can to prevent injuries and loss of life which includes the task of getting people to use that which is available and to use it at the proper time. Gibson explained the distinction between roof control and roof support and reviewed some of the methods and materials used to support roof. He drew on the experience of his own company to illustrate some of the problems in providing roof support for both conventional and continuous mining units. In conclusion, he said that as long as men are robbed of life or limb through roof fall accidents, the industry has not progressed enough.

C. H. Patterson, safety director, Rochester & Pittsburgh Coal Co., summarized the progress being made in Ventilating Continuous Mining Sections. He compared the use of line brattice tubing in ventilating a continuous mining section and then described several methods of installing fans and tubing that are being tried by the industry. It is quite evident, he said, that the immediate face area cannot be ventilated properly with auxiliary fan and tubing alone. As a needed aid in accomplishing this, booster fans are needed to keep methane content of the atmosphere at the immediate face below the requirements of the law. He also pointed out that when liberation of methane at the immediate face area and from the area already mined is greater than 40 cfm, multiple or larger fans should be used.

In discussing Patterson's paper, John B. Kebblish, general superintendent, Mountaineer Coal Co., described some of the Developments in Face Ventilation and Dust Control with Continuous Mining Equipment. He covered the face ventilation and dust problems encountered when using line brattice, the various experiments with auxiliary fans which were conducted jointly with the U. S. Bureau of Mines at the company's new Leveridge mine, and the auxiliary fan system of ventilation now in use.

The final paper of the session was presented by W. K. Dennison, Jr., mine superintendent, Kaiser Steel Corp. In describing the Koehler mine fire in New Mexico, he spelled out methods employed to advance into and to confine the burning area. He also included a description of the physical conditions encountered—roof, temperature, humidity and visibility—and their effect on recovery work. Of particular interest to the audience was a description of the results obtained by passing fire gases through a carbon dioxide chamber and re-introducing the result mixture into the fire area. It took 14 months, three-quarters of a million dollars and 3480 man-hours of work while wearing oxygen breathing equipment in a lethal atmosphere, to confine the fire to an area approximately 400 by 600 ft. Dennison emphasized that there was not one lost-time accident during the recovery operation.

UNDERGROUND HAULAGE —MANY NEW DEVELOPMENTS

A SESSION in underground haulage was also held on Tuesday afternoon. David Ingle, Jr., president, Ingle Coal Corp., served as chairman of the session, and John W. Straton, general manager of mines, The Lorado Coal Mining Co., as vice chairman.

In discussing New Developments in Mine Haulage, H. W. Meador, Jr., general superintendent, Stonega Coke & Coal Co., concentrated on belts. He pointed out that a number of significant developments had taken place in underground belt conveyor haulage during the past decade. Some of the more important ones, he said, are: the development of rope-suspended intermediate structure, changes in the basic design of carrying idlers, the introduction in this country of solid woven belting, and the development of conveyor equipment to serve as a link between a continuous mining machine and butt entry conveyor. Meador also considered the growing interest in the use of carrying idlers with 35° or 45° troughing angle, and the fact that a number of belt manufacturers are currently working on improved multiply and solid-woven belt constructions. Attention, he said, is being given to: evaluation of new synthetic fibers, development and evaluation of new rubbers and plastics, and improvements in fabric weave design which provide more efficient utilization of material capabilities.

The subject of new developments in underground Rail Haulage was covered by W. H. Coghill, assistant chief industrial engineer, Mines, Industrial Engineering Department, Republic Steel Corp. He emphasized that each mine haulage system, whether by rail or conveyor, whether a new or revamped job, should first be well-planned and well-engineered, not only to fit the volume to be moved, but also to fit the many other conditions peculiar to mining, such as grades, curves, clearances and speed. Finally, consideration must be given to the capital expenditure required and the resultant long term operational costs. According to Coghill, Republic Steel is constantly putting more and more emphasis on both the quality and cost of raw materials, particularly coal. In the past ten years, a great deal has been spent on coal haulage systems alone to help attain this end. For illustrative purposes, he described the haulage systems at the Republic mine, Banning mine, Ford Colliery and Clyde mine. He concluded that the final answer is always the cost of the product.

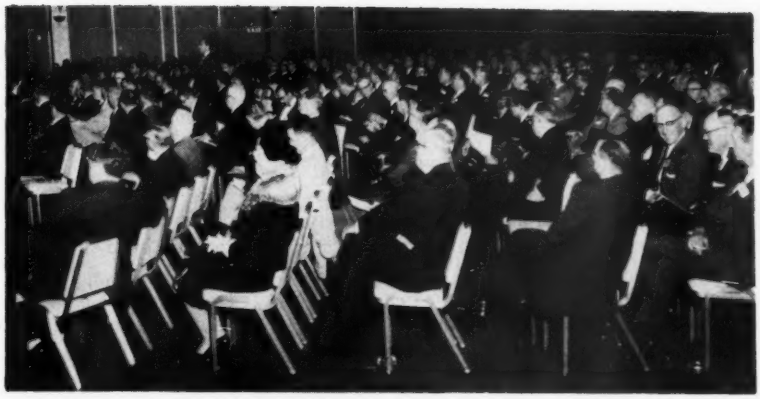
John S. Todhunter, general mana-

ger, Barnes & Tucker Co., discussed A New Development in Shuttle Car Haulage. For about 18 years shuttle cars have been one of the major transportation links in the Lancashire No. 15 mine of Barnes & Tucker Co. Storage batteries motivated the first cars used in 1941 and 1942, and they provided the experience and knowledge leading to the selection of four-wheel drive, cable-reel cars in 1942. Observations, trial and study of various shuttle cars by the coal company led to the selection of a recently developed six-wheel shuttle car. Although the cars have been in service only since January 1960, the resulting improvements in cost and tonnage have been gratifying.

Conversion of Existing Manual Hoists to Automatic Operation was the title of the next paper. Coauthored by Hollis Pierce, chief electrical engineer, Old Ben Coal Corp., and W. J. McDonald, application engineer, Industrial Engineering Section, General Electric Co. Presented by Pierce, the paper covered the dismantling and moving of a manual haulage 24 miles to a new location, redesigning the drums to fit a new duty cycle and depth, and converting it to automatic operation. Installed at Old Ben Coal Corporation's Mine No. 21 near Sesser, Ill., the hoist will accelerate a 48,000-lb load, including skips, ropes, and coal, and make 80 trips per hour through a total lift of 800 ft. The automatic loading and hoist controlling equipment is an integrated system. That is, as coal is received at the shaft bottom coal bin, automatic control equipment initiates transport of the coal from the lower coal bin to the surface coal bin. As long as coal is available, the system will continue to deliver. Pierce pointed out that the major reason for changing to an automated hoist today is economics. This automatic hoist and its integrated, automatic underground controls, he explained, can be expected to save six man-shifts per 24-hour day. The full text of Pierce's paper appears in this issue of *Mining Congress Journal.*

Buddie R. Morris, head, Industrial Engineering Department, West Kentucky Coal Co., Inc., presented a paper on Belt Maintenance. West Kentucky Coal has two mines operating with all-belt haulage. The belt haulage consists of 42-in. gathering belts and 30 and 36-in. panel belts. Both mines produce from 8600 to 10,000 tons of ROM coal daily with eight operating units. In describing his company's maintenance program, Morris stressed that preventive maintenance for belt haulage starts with the specifications for purchasing belts and belt drives and should exist throughout the installation and use for the life of the belt. As a result of its maintenance program, West Kentucky has experienced over a two-year period a delay time of only 0.5 percent on the panel belts and an average of 0.57 percent on the 42-in. main belts, or a total of 1.16 percent delay time on its belt haulage. With 6½ hours per shift at the face, this is a total of ten minutes per operating day, or approximately $65 per day loss due to belt delay. Replacement of 42-in. main line belts has been about 1000 ft since 1940, or an average of 0.14 percent per year. Replacement on panel belting indicates about 5.9 percent per year.

Maintenance of rail haulage systems begins with proper installation of track and trolley, according to J. S. Schrencengost, chief engineer, Allegheny River Mining Co. Schrencengost explained that one of the greatest problems facing management today is that of good and proper housekeeping on underground haulage roads. Allegheny River Mining Co., at its mines, uses a Model "30" Canton track cleaner and the results obtained from its use have been highly satisfactory, giving both rapid cleaning and the lowest possible maintenance cost. In closing, the speaker pointed out that there has been too much consideration given to holding down the original capital expenditure and thereby prohibiting the best construction and use of the best equipment. It is not the matter of how much the installation costs, but the rapidity with which that investment can be amortized in the maintenance of the system, he said.



Meeting rooms for the convention sessions were packed with interested mining men

MANAGEMENT AND COST CONTROLS— THE RIGHT MAN FOR THE RIGHT JOB

R. H. JAMISON, JR., president, Delmont Fuel Co., was chairman of the Wednesday morning Management and Cost Controls session. Vice chairman of the session was George McCaa, general manager, Ireland Mine, Hanna Coal Co.

People was the subject of the paper given by James L. Hayes, dean, School of Business Administration, Duquesne University. He explained that people lead many lives. The man in business is an employe of a company but he is also a father, a husband, a citizen, a member of a particular faith, a hobbyist and many other things. The job a man holds is his method of satisfying all his other roles. He works for satisfaction, it is true, but he also works for money. Hayes then asked the question, "How do we get people, satisfaction and money to go together?" First, he said, a man must know the job. What exactly does the

boss want? This has much to do with satisfaction. Next the man likes to know how he's doing. This is basic to improvement. The evaluation from time to time gives a man an estimate of which results are being obtained and which ones are not. Then comes growth. A man is inclined to improve himself to get results so as to earn his money. Money, then, is the reward for a job well done. This brings real satisfaction. It also stresses the human aspects of people rather than mechanical slavery.

Next a panel discussion was held on Personnel Selection. An industrial psychologist, a coal personnel manager and an industry executive discussed ways and means of getting the right man for the right job. Dr. Quin F. Curtis, chairman, Department of Philosophy and Psychology, West Virginia University, took A Second Look at Personality Testing in the Coal Industry. He pointed out that it is no longer necessary to "sell" psychological testing programs to industry. Rather, industry has become oversold to the extent of adopting psychological tests without the critical scrutiny that would be made of a large expenditure in another area of business. Curtis appraised the value of personality testing programs for first-line supervisors and for top-management personnel, and suggested the questions that ought to be asked and answered before embarking on a personnel testing program. He also pointed to the necessity of a continuous quality-controlled check on personnel-evaluation programs, and discussed why nobody in industrial organization is willing to conduct this essential check.

Personnel Evaluation and Selection was next considered by C. G. Evans, personnel manager, The North American Coal Corp. He told how North American, through the assistance of a psychological testing concern, set up a program that was tailored to the needs of the company's operation. The peculiarities in the mining industry were a main factor in determining the type and scope of the program, and it is still in an experimental stage in many respects. The company feels that hiring people of proper intelligence level, in conformity with the position, duties and promotional possibilities, is a must. It finds that the proper biographic and interviewing application, submitted with psychological testing, should assist its people in evaluation of social and personality weaknesses, enabling management to determine ability to maintain compatible relationships with the individual's superiors, co-workers, and daily contacts. Evans emphasized that great care should be exercised in determining personal characteristics that motivate or hinder work effectiveness.

According to the final panelist, John N. Crichton, executive vice president, Johnstown Coal & Coke Co., a sound program of Personnel Evaluation and Selection is an essential business tool in developing executive and supervisory talent. He explained that no fancy plans are necessary to add proper personnel evaluation and selection, or proper appraisal, but you must spend some time in self-appraisal. It is almost impossible to do a sensible job in selecting and evaluating without knowing yourself. In order to continue a proper evaluation and selection process, you must have a selection plan. Also, a system of continuing education must be instituted so that the best type of employe will be available at time of selection. These three items help to create a by-product of improved morale as all people would like to know "where they stand."

The next two papers were devoted to the use of Electronic Computers in Coal Mining. R. D. C. Morris, assistant to vice president—Coal, U. S. Steel Corp., described electronic computer activities in U. S. Steel's Coal Division. In the interest of obtaining optimum coal quality and consistency of product, he said, U. S. Steel has introduced a new tool to its coal operations known as statistical quality control. The function of the statistical quality control technique is to indicate when significant quality changes have occurred to the company's washed coal products as measured from accepted quality standards. This is made possible through the use of a digital computer which gives the company information with great rapidity so that positive and timely decisions can be made concerning the operation of coal washers, the blending of coals, and the burdening of blast furnaces. Morris also pointed out that the company's activities with the computer have extended into other fields. For example, a rather unique application of the computer has been in the development of production and equipment hour standards for continuous mining machines. A program has also been developed to calculate annual district operating plan balances resulting from normal annual clean coal requirements of the various coke works.

W. L. Zeller, assistant industrial engineer, Frick District, U. S. Steel Corp., discussed Underground Planning and Control Using Electronic Computers. One system of programming, which is in common use in the U. S. Steel Corp., is named Fortransit and is used on the IBM 650 computer. In the corporation's Coal Division, a considerable number of programs have been written using Fortransit and many more are planned for the future. One computer program is a simulation of continuous mining with a milling type miner; a practical application of electronic computers to a problem in underground mining. It is an extremely useful and valuable program because with it, different equipment, mining plans, or working methods can be swiftly evaluated, the effect of natural conditions can be determined, and it will compute accurate production standards, which are essential for an effective cost control system. To illustrate the value of this simulation program, Zeller described a series of nine evaluations, and discussed the time required to prepare the data checks, the computer time required for the analysis, and the result.

UNDERGROUND POWER— A-C DISTRIBUTION AND D-C MAINTENANCE

A SESSION on underground power was held Wednesday morning with John Stachura, vice president, Enoco Collieries, Inc., as session chairman. Vice chairman was James A. Erskine, electrical engineer, Eastern Gas & Fuel Associates.

F. G. Hamner, system planning en-

All phases of coal mining technology were discussed in the meeting rooms. Here Jack Hamner, Southern Services, Inc., describes a-c power systems installed in two Alabama coal mines. John Stachura, session chairman, and Jim Erskine, vice chairman look on

gineer, Southern Services, Inc., discussed the power distribution systems installed at two new Alabama coal mines by the Alabama Power Co. and the Georgia Power Co. in a paper entitled, Design of a Power System for a New Mine. In general, the power system is identical with that proposed by the AMC Committee on Underground Power. Power is supplied from the utility at 46,000 volts and stepped down to 12,470 volts, grounded wye, at a power company substation before metering to the mine. No voltage regulators are installed at present but space is provided for their possible future use. Power is stepped down directly to 440 volts delta for all above ground use. Underground feeders are supplied at 4160 volts, ground wye. All the equipment that is in the mine is a-c powered with 440 volts except that a d-c trolley system is provided for hauling supplies. A 150-kw silicon rectifier supplies the trolley system.

Silicon Rectifiers for mining service was discussed by Ralph E. Wahl, senior engineer—d-c equipment, Low Voltage Switch Gear Department, General Electric Co. Advantages claimed by silicon rectifiers, Wahl said, are 30 percent lower cost, reduced weight, exceptional reliability, and higher efficiency. He then went on to discuss the design characteristics of silicon rectifiers, concluding by pointing out that silicon rectifier cells capable of phase control are under development, but are not yet available.

In discussing the Wahl paper, C. L. Sarff, chief engineer, Ireland Mine, Hanna Coal Co., covered 2½ years of experience with silicon rectifiers. While simplicity in design and cost were things that could be determined ahead of time, reliability was a factor that could not be proved in advance. Today, Hanna Coal Co. has two 500 kw silicon rectifiers in service at the Ireland mine—one has been in service 15 months and the second 2½ months. Sarff said that his company's experience with silicon rectifiers indicate that they are the most economical, most reliable and simplest conversion unit on the market today.

Otis G. Stewart, executive engineer, Union Carbide Metals Co., covered 20 years of experience with a-c coal mining. These 20 years have borne out what have been claimed for a-c power by many speakers, Stewart said—increased safety, reduced maintenance, and improved cable service.

A. E. Molinski, superintendent of maintenance, Bethlehem Mines Corp., discussed maintenance of mine power systems. Pointing out that d-c power is still with the coal industry, Molinski stated that any power system maintenance program hinged about proper voltage, proper installation, an awareness that the return side of a d-c system is no less important than the positive side, and the importance played by trailing cable in power distribution.

Frank R. Hugus, chief electrical engineer, Joy Manufacturing Co., next described a study of the AMC Committee on Underground Power to show how trailing cable life can be extended. Speaking for the Power Committee, Hugus pointed out the great potential savings in proving cable trailing performance and submitted a questionnaire which will be shortly circulated throughout the industry to gather data on trailing cable failures.

THICK SEAM MINING— PLACE FOR BOTH CONVENTIONAL AND CONTINUOUS EQUIPMENT

WEDNESDAY afternoon the Thick Seam Mining session was held under the chairmanship of C. O. Kane, manager, Coal Mines, Armco Steel Corp. James A. Younkins, assistant general superintendent, Duquesne Light Co., served as vice chairman.

First speaker of the afternoon was Harry LaViers, Jr., vice president, South-East Coal Co., Inc., who discussed Conventional Versus Continuous Mining Equipment in Seams 38 to 48 Inches Thick. South-East has shifted from conventional to continuous mining with a resulting increase in productivity of from 30 tpd per man to 50. The change in mining equipment brought with it a new approach to mining problems. LaViers told how continuous mining has caused the company to make some very pronounced changes in its methods of mining—not so much in the way projections are laid out, but in the way management employs its manpower. Maintenance, personnel problems and safety were other topics that he touched upon. He concluded that the potential of continuous mining is just now being touched upon. LaVier's paper appeared in the April issue of *Mining Congress Journal.*

Factors Affecting the Choice Between Continuous Miners and Conventional Equipment was the subject of the paper presented by W. F. Diamond, manager of engineering, Island

Intense interest was shown in the technical sessions

Creek Coal Co. He said that the choice of whether to use continuous mining or conventional equipment in a mine is dependent upon the analysis of a great many factors. He touched briefly on some of the more significant ones such as adaptability of available machines, anticipated markets, haulage equipment, unit production rates and costs, and capital costs. He brought out that no choice of equipment can be made that will have all the advantages and no disadvantages; as a consequence, the selection made must involve compromises. The final choice, he said, will depend upon the value those making the decision place upon the advantages they get and the disadvantages they must accept with the equipment finally selected. To illustrate this, he told how Island Creek was faced with the necessity of making a choice of the production machines to be used in the re-equipping of three mines. His keen analysis of the decisions made and how they were arrived at proved intensely interesting to the audience.

E. H. Greenwald, partner, Eavenson, Auchmuty & Greenwald, was the next speaker. He considered Equipment Needs and Trends for Mining in Seams Over 48 Inches Thick, but limited his talk to consideration of equipment and related procedures at the working face, including face and intermediate transportation. The presentation was based on a survey of mining equipment manufacturers as to what they plan, along with the opinions of operating men and comments from consulting engineers viewpoint.

The last speaker of the afternoon was R. L. Anderson, commodity industry-analyst, U. S. Bureau of Mines, who spoke on Productivity of Continuous and Conventional Mining Equipment. Total production of bituminous coal and lignite mines was 287,000,000 tons in 1958. Mines with mechanical loading produced 246,000,000 tons, while mines with 100 percent hand-loading produced 41,000,000 tons. Production by continuous mining increased from three percent of the total underground production that was mechanically loaded in 1952 to an estimated 29 percent in 1959. The major decreases in conventional mining during this period occurred in "mobile loading into mine cars" and "scrapers and conveyors". One group, "mobile loading into shuttle cars," produced 28 percent of the underground output in 1958 and averaged a higher productivity than any other except "continuous mining only." Total production of bituminous coal and lignite in 1958 was 410,000,000 tons, and the average productivity for all mines was 11.33 tpd per man. The full text of Anderson's paper appeared in the May issue of *Mining Congress Journal.*

Tax Forum

The Tax Forum for coal men on Wednesday, presided over by AMC Tax Committee Chairman Lincoln Arnold, was notable because of the active participation in discussion by the tax men attending. The items discussed included: the Treasury's recent favorable ruling to the effect that a net operating loss deduction does not reduce percentage depletion; the pending Supreme Court decision on allowable ordinary treatment processes; state taxation of interstate commerce; legislative, administrative and judicial developments with respect to depreciation; the Treasury's recently-issued natural resource regulations. and the definition of "property" for depletion purposes.

Of particular interest was the discussion of salvage value. It became clear that revenue agents are paying increasing attention to this item in considering depreciation schedules, and the discussion pointed up the value of maintaining adequate records to prove the actual experience of the taxpayer, particularly where salvage income is little greater than the cost of recovery of the scrap.

The dividing line between leases and sales of mineral received considerable attention. In recent years several courts have held that agreements which appeared to be leases with a royalty were in fact sales of the mineral, thereby entitling the owner to capital gains treatment. In some areas revenue agents are now scrutinizing lease agreements to see whether they might be held to be sales agreements —with the result that the royalty would have to be capitalized by the leasee.

Land and Water Use

A joint meeting of the Land and Water Use Committees of the American Mining Congress and the National Coal Association was held Wednesday under the joint chairmanship of R. L. Ireland and Walter F. Schulten.

A review of pending and prospective legislation in the field of land use and water and air pollution was given by AMC Executive Vice President Julian Conover. Following this a symposium on problems encountered by the various extractive industries was held. Industry papers were presented by the following: iron ore, Hugo E. Johnson; sand and gravel, Edward K. Davidson; cement, Ellery Sedgwick, Jr.; phosphate, C. Lester Richards; bauxite, Roy F. Miller, and bitumi-

The Land and Water Use Committees of the American Mining Congress and National Coal Association discussed problems encountered by the various extractive industries in the field of water and air pollution

nous coal, Larry Cook. Reports were also made by John R. Atkinson, copper; E. T. Powell, anthracite coal, and S. H. Williston, strategic minerals.

During the discussion period following the symposium, Mr. Ireland said that industry should attempt to set up inter-city, inter-county or interstate compact organizations as a means of solving air and water pollution problems in preference to Federal government expansion into these areas. It was the consensus that the mining industry is making progress in correcting water and air pollution problems in cooperation with local government and state agencies.

C. Fred Gurnham, American Mining Congress delegate to the National Technical Task Committee on Industrial Wastes of the U. S. Public Health Service, said that public awareness of air and water pollution problems is increasing, and urged the mining industry to publicize locally its expenditures for air and water pollution control facilities.

At a noon luncheon meeting, members of the committees voted to hold their next joint session during the AMC Metal Mining-Industrial Minerals Convention and Exposition at Las Vegas, Nevada, October 9–14, 1960.

Stream Pollution

Regulations of the Ohio River Valley Sanitation Commission (ORSANCO) as they pertain to coal mining were the subject of a panel discussion Wednesday afternoon. Participants were: Larry Cook, chairman of the AMC Land and Water Use Technical Committee; Ernst P. Hall, research consultant, Consolidation Coal Co.; Henry Hebley, research consultant, Coal Advisory Committee to ORSANCO, and L. E. Sawyer, director of conservation, Mid-West Coal Producers Institute.

Coal mine operators at the well-attended session were urged by panelists to acquaint themselves with ORSANCO Resolution 5-60 which sets out the policy and procedures to be followed to control acid mine-drainage in the eight ORSANCO Compact states — Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Virginia and West Virginia.

The speakers urged cooperation with ORSANCO in alleviating acid drainage and predicted that pressure for anti-pollution action by the coal industry will increase as a result of installation of water pollution control facilities by other industries and communities.

Special ladies' events included an Hawaiian luncheon, and fashions show

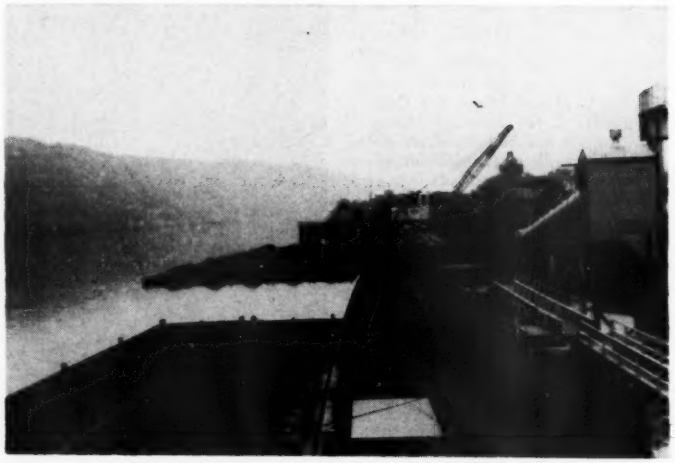
Ladies Events

Mining Ladies were kept busy with a special program all their own. Tuesday, May 10, a sightseeing trip included such impressive sights as the historic Golden Triangle and the beautiful Oakland Civic Center, as well as a visit to the famous Nationality Rooms of the University of Pittsburgh's Cathedral of Learning. It concluded with a luncheon at the beautiful Longue Vue Club overlooking the Allegheny River. Our newest state was honored Wednesday noon with a Hawaiian Fashion Luncheon at which Hawaiian fashions adapted for mainland wear were modeled by AMC ladies.

Entertainment

In addition to the Sunday afternoon reception, two special parties were held. Monday evening saw mining men and their ladies gathered for the traditional Coal Miners party. Fine food, excellent dancing and an outstanding program of entertainment marked this occasion.

The Speechless Banquet Wednesday evening saw brief introductions of industry leaders by Robert H. Hughes, Program Committee Chairman, followed by another sparkling entertainment program.



Among the highlights on the trip to U. S. Steel's Maple Creek operation was the barge loading and unloading facility at the preparation plant

Mine Visits

A special treat was offered convention-goers Thursday — a chance to visit either of two modern coal operations. One group toured Hanna Coal Company's Cadiz, Ohio, property. During the morning they examined the Georgetown preparation plant, one of the world's largest, and the crushing plant and initial pumping station of the famous coal pipeline. Following a "mighty fine" lunch at the Cadiz Country Club, the trip continued with a first hand inspection of Hanna's land reclamation program and strip mining operations. A close-up look at the 65-yd "Mountaineer" provided a fitting climax to the well-organized tour.

The second trip was to New Eagle Borough for a visit to the Maple Creek preparation plant and mine of U. S. Steel Corp. The group of coal miners first looked over the surface installations of the Maple Creek mine, which is now under development. They closely examined the ultra-modern automatic hoisting facilities at the Ginger Hill shaft, where plant and mine refuse is removed and disposed of, some three miles away from the Monongahela River, on which the plant is located. Following luncheon, a tour was made of the plant and its coal storage and river dock facilities.

A stop during the visit to Hanna Coal Co. offered an opportunity to inspect the 65-cu yd Mountaineer

Next Year

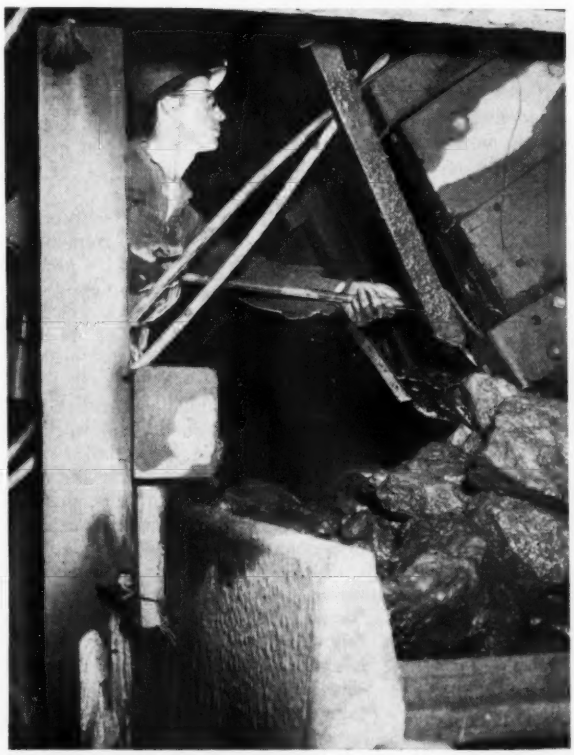
Another Mining Congress Coal Convention has been entered on the pages of history. As those who attended returned to their jobs to put into effect the new ideas learned during the meeting, plans were already being made for the giant Coal Show to be held in Cleveland's Public Auditorium, May 15–18, 1961. All indications point to another excellent exposition and work will soon start on assembling the technical program. Coal mining has never stood still, and at the rate new ideas and equipment are being introduced, the 1961 Coal Show will be a "must" for those who produce the fuel that powers America's progress.

Viewpoints on Safety

Part II—What Safety Means to the Miner

Safety rules set down by the company are for the miner's protection and he profits by observing them

By JOHN PERKOVICH, Miner
Homestake Mining Co.



A full year without a lost-time accident entitles the miner at Homestake to a cash bonus for his alertness to safety

WHAT does safety mean to the miner? It means that he must familiarize himself with and conform to the safety rules set down by the company. He knows that he profits from these rules, which are made for his protection, just as he profits from past experience through the misfortune of a fellow workman's accident.

Responsible department heads, safety engineers, division foremen and crew foremen all talk safety to the miner, but this is to no avail unless the individual himself does something about it. He must learn to work safely, to cooperate with his fellow workmen and to respect the decisions made by his superiors. Homestake officials are doing everything possible to make working conditions safe for the miner.

Scope of Safety Program

Movies showing pictures concerning safety measures are shown to the

(*Continued on page 56*)

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miner by company safety engineers. These pictures show in detail the right and wrong ways of doing a job, and they stress what consequences may result if the job is done wrong —they also show the proper steps that should be taken before the work day begins.

In addition to the movies, the men are visited in group form by safety engineers who encourage them to keep up their good safety habits and remind them constantly that by working safely today, they will be here tomorrow. They also stress the fact that the men should guard the accident-free hours already accumulated. By doing this, they not only protect themselves and their fellow workmen, but the welfare of their families as well.

Monthly safety meetings are held. The mine department head meets with his division foremen, safety engineers and crew foremen. One miner out of each foreman's group is invited to attend the meeting. Safety and welfare of the miner, plus the efficiency of the equipment he operates, are discussed at these meetings. The miner *is free* to make any suggestion pertaining to the betterment of safety or operation.

A suggestion box for both safety and operation is installed at each change room building. Each miner, maintenance man and laborer is encouraged to use these boxes for any suggestion concerning safety or operation. These suggestions are picked up at regular intervals and are discussed by the safety committee. If any suggestion proves to have merit, and is adopted, the individual making the suggestion is personally congratulated for his safety mindedness and is awarded a cash prize.

Prizes, Cash and Dinners Awarded

Safety dinners, based on the number of accident-free hours accumulated, are given by the company for the miners and their ladies. Two years ago the writer was fortunate in being one of the men in the first group who set a safety record at the Homestake mine. That record is still held—two and one-half years without a lost-time accident—and it is hoped that it will be broken. Since this record was established, seven more dinners have been given for safety-minded crews and their ladies.

To create more interest toward safety, the company awards watch fobs, wrist watches and cash bonuses. In the required amount of time without an accident, the miner is awarded first the bronze, then the silver and then the gold watch fob. After more time, he is given a handsome and expensive wrist watch with his name engraved on it, which is presented to him at a special safety dinner given by the company for these men and their ladies. Each miner who completes a full year without a lost-time accident is given a cash bonus for his alertness toward safety.

The author believes that the threat of suspension contributes much toward the cause of accidents. When a man is threatened with suspension, he is more likely to become accident prone. If he is doing his job in the wrong manner, he should be told how to do it correctly instead of being threatened. If the threat of suspension hangs over a man he is apt to become confused and start worrying about the grocery bill, rent, house payment and so forth. The man who has this threat on his mind cannot have his work or safety habits on his mind. At Homestake, it has been the policy of the mine department head and division foremen to correct a man rather than threaten him with suspension. Of course, the plant is not perfect, and occasionally a man gets suspended because he ignores the safety rules—but usually he is warned first. If the suspension does not help, and he continues to ignore the safety rules, then the safety and welfare of this man and his fellow workers profit by his release.

Miners Take Pride in Working Safely

Each morning as the men go down to receive their lamps, the first thing that they see is a huge safety bulletin board. Appearing on this board is the name of each division foreman and his crew foreman. This board indicates month-by-month the lost-time accidents charged against the crew foreman and his division foreman. The miner takes great interest in this board and does not want his name to appear on it as this would indicate that he has neglected his safe working habits. The writer is proud to say that the division which he comes under has had a total of only four lost-time accidents as of this date.

At the present time, the mine department is enjoying a tremendous decline in accident rate. So great is this decline that the company has received second place in national safety competition. What brought about this decline in the accident rate? The miners believe that this has been accomplished through constructive management who work for and with the men, and who are constantly on the alert for safer and more efficient equipment and tools, and who cooperate with department heads—plus department heads who cooperate with division foremen, and division foremen who cooperate with crew foremen. When any industry attains this kind of cooperation between management and employes, they will certainly enjoy the same benefits as miners of the Homestake Mining Co. are enjoying today.

Group of Homestake miners who were honored by the company at a dinner in recognition of having worked 169,000 hours without a lost-time accident

Viewpoints on Safety

Part III—Administering a Safety Program

A good safety program is a must in any industry, but there are certain aspects of potash mining, peculiar only to this type of operation, which make a good safety program doubly important and challenging

By ROBERT A. WHITE
Safety Supervisor
Southwest Potash Corp.

POTASH ore bodies in the Carlsbad district of New Mexico are found in an extensive horizontal strata lying approximately in the center of an underground salt bed several hundred feet thick. Mining is carried on by a modified room-and-pillar method involving the so-called primary and secondary phases of ore extraction. Primary mining consists of driving entries approximately 32 ft and leaving 60 by 60-ft pillars standing. These pillars are mined out at a later date during the retreat cycle; such operation is commonly referred to as the "secondary mining."

The plasticity of the salt beds in the roof members allows for a gradual and controlled subsidence of the entire strata over the mined out area. As a general rule, neither timbering nor roof bolting is necessary because of the very stable nature of the ground. Gas and dust explosion hazards are practically non-existent. Ventilation is good, all mines are exceptionally dry, and pleasant year-around moderate temperatures prevail in the underground workings. Operations are completely mechanized. Some companies employ continuous miners and belt systems; others use track haulage and conventional coal mining equipment such as undercutters, hydraulic drills, loading machines and shuttle cars.

Guard Against Lax Attitudes

The potash mines are relatively safe in comparison to hard rock and coal underground mining operations throughout the country. It is this very fact which, to a certain degree, breeds a lack of vigilance on the part of employes and creates a problem in administering an effective safety program. Management firmly believes that safety pays dividends and strives to convert its employes to this same way of thinking. In essence the problem is—how to keep all employes safety-minded; how to prevent a natural relaxation in their attitudes leading to the tendency of disregarding good safety practices.

The writer would like to relate some of Southwest Potash Corporation's experiences in achieving a tolerable safety program commensurate with existing operating conditions in the district. Since its inception, the company has had a number of programs in operation.

Over 90 percent of Southwest's employes came from the coal fields of Illinois, Ohio and West Virginia. Generally the mill employes were not from coal mines. A good majority of these men had various degrees of safety training and backgrounds; some had none at all.

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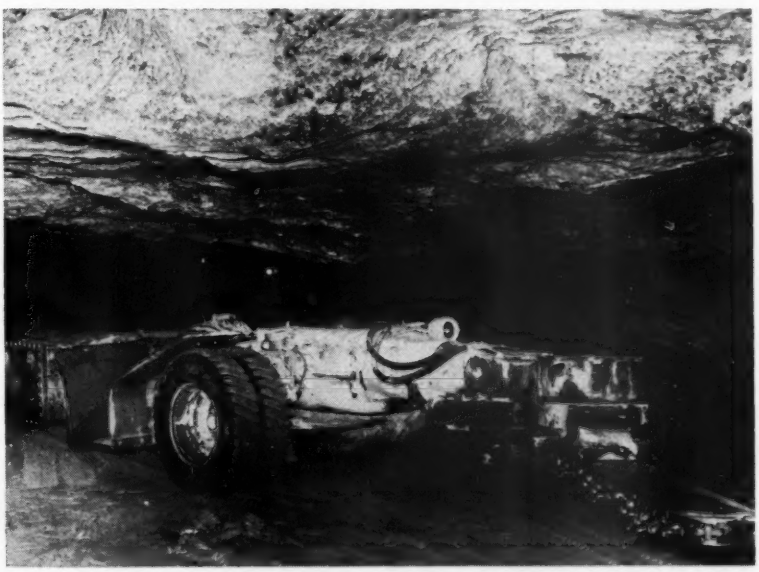


High accident frequency rates at Southwest Potash are believed to be due principally to a provision in the company's labor contract which authorizes disability leave pay

(*Continued from page 57*)

Safety Cannot Be Bought

Numerous well known safety schemes, such as employe suggestions and time card jackpots were tried in an attempt to instill safety-consciousness throughout the operation. However, these devices were found to be only partly effective, and proved once again that safety cannot be bought.

However, through persistence in working out a good safety program, experience pointed the way, and the following successful practices resulted:

1) Compulsory first-aid training for all first line supervisors. Hourly employes are urged to avail themselves of this valuable knowledge also. Classes are provided under the auspices of the U. S. Bureau of Mines.

2) Monthly safety checks are made throughout the mine and mill by the safety supervisor, who is accompanied by a union safety committee. This group inspects the plant, seeks out potential hazards and makes appropriate recommendations for their correction. Any possible unsafe practice is discussed on the spot with the employe concerned. Much cooperation has been gained through this method.

3) Letters are sent to supervisors calling attention to unsafe conditions found in their sections. The letter must be answered and should include a statement regarding corrective measures taken.

4) Letters are also sent to accident-prone employes. These letters point out the individual's accident record and compare it to those of fellow workers —and what it means in terms of cost to the company. This idea was responsible for a reduction in Southwest's cost and severity during its first three years of operation.

5) Supervisory meetings are held twice a month. Safety is always on the agenda and discussed some time during the meeting.

6) Safety posters, "Danger" signs and slogans are located throughout the surface plant, underground shop and workings.

7) Safety glasses and replacements are furnished by the company. Prescription safety glasses are procured at wholesale prices for those who need them. The employe must wear them for any work hazardous to the eyes.

8) Hard hats and safety shoes are required on the surface as well as in the mine. All persons, including visitors, must wear hard hats upon entering the plant.

9) Rigid physical examinations are required for all underground personnel. Thirty percent of the applicants do not pass. The examination includes two back x-rays, chest x-rays and electrocardiagram.

10) Periodical statistical reports are issued to all foremen showing accident costs for each supervisor.

11) Another report informs the foreman of the tons lost per day due to lost time accidents of his men.

12) All employes are required to report to their supervisor any accident, no matter how trivial.

13) The supervisor must make a report of every accident. These are twofold in nature:

a) A first-aid report is made if the injury does not require the services of a doctor.

b) If the injury requires medical attention, a more complete report is filled out. This shows what caused the accident and makes suggestions for prevention of a future recurrence.

One cause of skyrocketing costs was the habit of employes seeking treatment from several different doctors when injured on the job. To resolve this problem, the company had many consultations with the doctors, explaining their viewpoint and making them aware of the problem. At the present time employes who are injured are directed to a company-approved doctor. If the employe prefers to consult his family physician instead, authorization must first be obtained from the company. This was not an easy matter to accomplish, but it has paid off in lower costs.

The Workmen's Compensation Act of New Mexico allows a company to become self-insured, if desired. Southwest became self-insured in 1953, thereby decreasing its cost to a great extent. Rates decreased the first year in mining by 6.21 percent, and in milling 1.67 percent. This trend has continued each year to date.

Severity Rate Lower, Frequency Higher Than in Other Mining

Anyone reviewing Southwest's frequency and severity rates will find it difficult to arrive at a true comparison with any other type of mining. To demonstrate the point, the severity rate of accidents at Southwest Potash in 1958 was 770.56 as compared to 3950.0 in other than coal mining, and 5975.0 in coal mining. On a national basis, the days lost per case were 11, 259 and 218 days respectively. This is due partly to fatalities in the national figures, while Southwest had no fatalities. Southwest's frequency, however, was much higher, being 97.84 in the mine and 40.67 in the mill, compared nationally to 15.23 in other than coal mining and 27.39 in coal mines. This was caused principally by a provision in the Southwest labor contract which authorizes disability leave pay. This provision allows five days of pay a year to each employe who is absent due to illness or injury. Such leave starts on the first day off with an occupational injury, while there is a two day waiting period for non-occupational absences. The union also has a check-off fund of $1.00 per employe. Any disabled employe who is off for either 30 or 90 days is eligible for this checkoff. It is easy to see that an employe who has been disabled for three weeks may attempt to remain off another week to get the check-off.

Although Southwest is very much in favor of employe protection against sickness and injury, it is worth emphasizing the pitfalls arising from such negotiated disability leave benefits. Any operation not presently exposed to this fringe benefit will be well advised to consider all pros and cons of union demands along this line.

Since the end of World War II, the ways and means of safety enforcement have undergone a drastic change. Now-a-days, a safety program has to be sold to the worker and it has been Southwest's experience that this can be accomplished successfully through the personal approach. A sincere endeavor is being constantly made to convince each and every man on the payroll that safety does pay.

"I wish you would wear ear-plugs in the mine or something."

Continuous Mining in Seams Less than 38 Inches Thick

Stotesbury No. 10 mine has run the entire gamut of mechanization. Today it is averaging 85 tons per man on the section with a continuous mining machine

By K. S. HOBBS
Superintendent
Eastern Gas & Fuel Associates

IN the last seven years the coal industry has experienced a great movement toward more efficiency and cheaper means of producing coal.

It is true, the advent of mechanization started over 20 years ago, but the real spark was experienced after the continuous miner came on the scene. Even the machines which had been developed and in use up until this time took on new vitality.

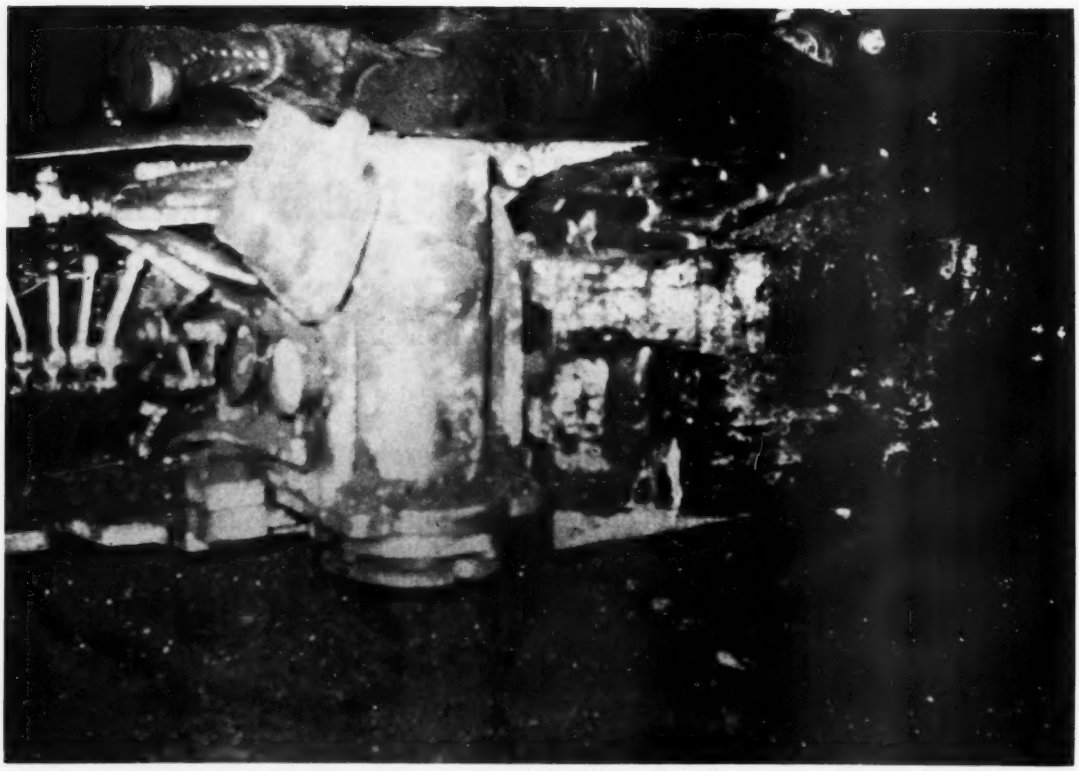
The continuous miner made its first showing in middle and high-range seams. Many, many words have been written about the successes of various methods using continuous mining machines in these seams, and even in so-called low seams. However, after investigation, the seams referred to as low stopped at a minimum of 38 in. The industry is now experiencing a continuation of the advance towards modern coal mining, namely, continuous mining in seams less than 38 in.

There has definitely been a movement toward mechanized mining in low coal, but it has progressed at a slower pace than in higher seams. The first decisive step in this direction was the introduction of chain conveyors. The era of hand loading on conveyors enjoyed many years of success with no strong break from this method of mining until the last three or four years. The first mechanical loaders employed in low seams were, for the most part, too high for efficient operation, but were made to work by sheer will power. This was the beginning of a period of amazingly fast development of all types of mechanical loaders, as well as auxiliary equipment, for low coal. Although the industry is still in a period in which conventional loading equipment is being developed for the lowest possible ranges in the seams less than 38 in., it is also experiencing a period of development of continuous miners for this same height range. There have been a limited number of miners which have proven successful to date in the low seams, and there are several in the experimental stage making their bid for recognition. The industry is almost certain to see a number of machines developed in the very near future to the point where some form of continuous mining can be introduced into a surprising variety of conditions in the real low seams.

Boring-Type Machine Chosen

Stotesbury No. 10 mine of Eastern Gas and Fuel Associates at Helen, W. Va., has gone through the entire gamut of mechanization. The operation is a drift mine in the Pocahontas No. 4 seam with a height range of 31 to 40 in., averaging 34 in. The mine was opened with hand loading on conveyors, progressed to conven-

A boring-type machine is successfully handling a two to eight in. middle band of rock of considerable hardness at a drift mine in the Pocahontas No. 4 seam



Position of repairman when making certain repairs to hoses in thin seams. Hydraulics of the machine are, by far, the outstanding single maintenance feature. With pressures averaging 2000 psi and the inaccessibility of hoses and pumps, a thorough knowledge of hydraulics is necessary to do a satisfactory job of trouble shooting

tional loading machines too high for the seam, then to low-type loaders, Piggyback conveyors, shuttle cars, and finally to continuous mining. Haulage consists of 30-in. butt entry belts and 36-in. main belts to the tipple. Present production at No. 10 mine averages 2400 tpd, 40 percent of which is produced by the continuous miner. Conventional loaders with Piggyback conveyors and shuttle cars produce the remainder.

After considerable experience by Eastern with the prototype of the Jeffrey 86-A Colmol at various operations and under differing conditions, it was decided the 86-A would perform successfully under prevailing conditions at No. 10 mine. This decision was reached on the basis of seam height, roof and bottom conditions and softness of the Pocahontas No. 4 coal. The one item of doubt centered around a two to eight-in. middle band of rock of considerable hardness. However, it was decided, after analysis, that this band could be handled by a machine with the penetrating power of the 86-A.

The 86-A Colmol is a 44-ton monster, 34 ft long, with a 14-ft 7-in. wide cutting head and a cutting height ranging from 28 to 44 in. The machine is a boring-type miner with eight cutting arms containing 64 bits, and two cutter-gathering chains containing 128 bits, or a total of 192 bits. A cutter across the top of the head is used for removing the cusps or sharp points left at the top of the face by the cutter arms. Three motors power the unit—two cutter head motors rated at 70 hp continuous and one pump motor rated at 50 hp. Actually, the motors are interchangeable, but the head motors are air-cooled, thus the higher rating. The chain conveyors taking coal from the miner are driven by the same type motor, providing an emergency changeout.

Good Planning and Preparation Pays Dividends

Anticipated results have been more than fulfilled in the first eight months of service. However, this did not just happen, but took much planning and preparation. For instance:

I. There are certain optional features available for the machine, and an analysis had to be made of each feature. It was decided to incorporate the following:

A. Four external hydraulic jacks. These provide a means of helping to maneuver the machine in adverse conditions, such as, soft, uneven bottom.

B. Correct length of arms. Arms are provided in 14, 16 and 18-in. lengths. The 14-in. length was selected to provide maneuverability and permit mining in the lowest range of the seam. Although the entire height of the seam at this installation is not cut with the arms, the coal readily separates from the roof and is picked up by the conveyor of the miner.

C. All improvements made to the machines at other installations were incorporated in the new machine.

II. The exact dimensions of the machine were obtained and it was decided, after measuring underground, to tram the machine 2500 ft in a six-ft high track entry to a suitable location for assembly, attach the head and head motors and continue tramming 2500 additional feet in seam height to the selected mining location.

III. Operating procedure was detailed:

A. Projection was laid out.

B. System of mining was outlined.

C. Auxiliary equipment was selected.
D. A crew was proposed.

Projection Had to Evolve Around Developed Area

The method of mining as set up originally, and still in use, is a simple room-and-pillar system. The projection layout is a series of butt entries driven off the main entries on 650-ft centers with rooms on either side. Development is accomplished with conventional loaders and shuttle cars. No top or bottom rock is taken for height on butt entries. The rooms are developed and retreated on alternate sides from the top and in groups of three or four on each side.

Rooms are driven with the miner on 60-ft centers, 28 ft wide to a depth of 325 ft. The room is developed by a series of two parallel lifts 14 ft wide by 18 to 24 ft deep with a delay period in between for panning up. Two breakthroughs are driven one lift, 14 ft, wide on 70-ft centers at a 60° angle. After the conveyor line is extended, the back end of the room is fanned out and the pillar is attacked in lifts paralleling the breakthroughs. At this point, considerable tonnage is obtained without panning up or removing pans. The roof is controlled exclusively by posts and cribs. By the time the miner returns to the room entrance (this usually takes two shifts or one work day) the next room is ready with a set-up of duplicate equipment, except for the miner. A move can be made on shift in as little as 20 minutes.

The above projection may seem like an antiquated method, but a system had to be worked out to answer these fixed requirements:

I. Least amount of tram time. The Colmol is a big machine and much tonnage can be lost in maneuvering and moving.
II. To provide maximum advantage for the highest potential tonnage.
III. The projection had to evolve around the developed area available at the time. Room and pillar work had been in use with conventional loaders and Piggybacks and seemed a natural for the situation at hand.

Panning-Up Poses Major Source of Delay

Under this system of mining, the only item separating this layout from true continuous mining is a 15 percent delay for panning-up. When the miner is running, there is a continuous flow of coal from the face to the tipple.

The complement of equipment is as follows:

1—86-A Colmol
2—Bridge conveyors
1—Chain conveyor line, extending up to 280 ft long
2—50-hp crawler-mounted drives for chain conveyor
1—T-4 crawler-mounted tractor
30-in. butt entry belts
36-in. main line belts

The crew consists of:

1—Foreman
1—Continuous miner operator
2—Pan-up men
1—Timberman
½—Clean-up man

5½ Total

Production Averages 85 Tons per Man

Production figures have been most rewarding since the installation. A long range average of eight months has produced a figure of 472 tons per shift at 85 tons per producer. This period has included several shifts of over 700 tons and better than 140 tons per producer.

A typical timestudy for this period will read as follows:

Tonnage	472
Tons per man	85
Average penetration	24 in. per minute
Total Time	440 minutes

Breakdown of Time

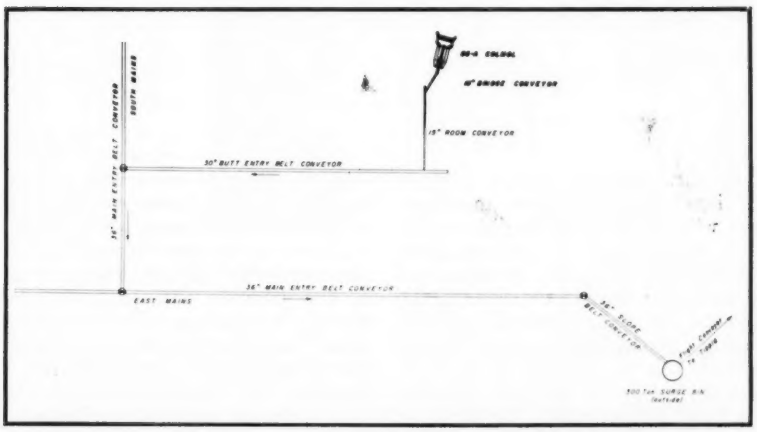
Operation	Time	Percent of Total Time
Loading	201 minutes	45.65
Tram time	82 "	18.65
Pan time	66 "	15.00
Delay time	91 "	20.70

Breakdown of Delays

Delay	Time	Percent of Delay Time
Oil hose replaced	45 minutes	49.45
Observe top	14 "	15.38
Groundicator repair	13 "	14.29
Pan line down	12 "	13.19
Power off	7 "	7.69

If some form of continuous haulage from the miner were incorporated to eliminate the 15 percent lost time panning-up, the potential tonnage under a 100 percent continuous mining system would be staggering. Not only would the 15 percent figure be recovered, but the psychological effect of not stopping the machine would possibly increase efficiency. Such a system is now available and is being considered for use behind the miner for development of butts and main entries.

This rate of mining requires detailed planning monthly, daily, and by the minute. First, a progress projection to schedule the development of butt entries and main entries to make areas available for the miner must be laid out and adhered to religiously. Second, the new room set-up becomes a daily job. This procedure was an exhausting and time-consuming operation with the use of skid-type conveyor drive units; however, with the incorporation of two crawler-mounted drives and one crawler-mounted tractor, the job of setting up the new room is accomplished nightly by three men in five hours. Third, the detailed planning by the minute involves a systematized procedure of handling the Piggyback, conveyor pans, conveyor chain, sight line, timbering, attack of the parallel room lifts, attack of the pillar and possible moves to new rooms on shift.

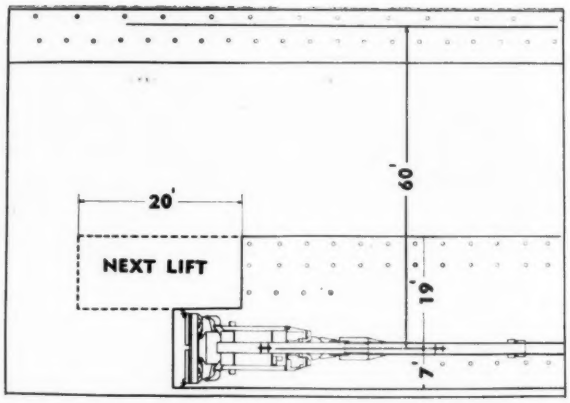


Schematic flow of coal from working face to tipple. The high rate of mining requires detailed planning monthly, daily, and by the minute

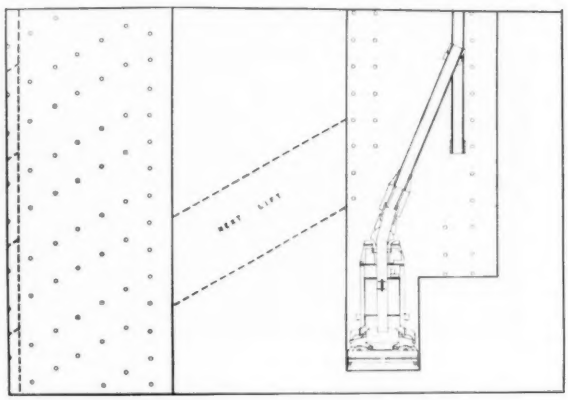
Trailing Cables Made Up of Two Single Conductor Cables

The merits of good, constant electrical power to continuous miner sec-

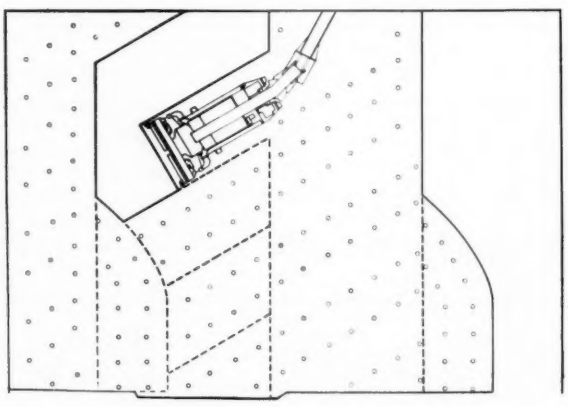
tions has been dealt with in technical papers both as a subject by itself and as a supplemental subject. However, in an all-belt mine the transmission of power from the substation to the miner depends on cable strung solely for that purpose and not on some dual-purpose conductor, such as trolley wire or track. It was found necessary to lay two 1,000,000 circular mil feeder cables for the positive line and to 1,000,000 circular mil feeder cables for the negative line from the conversion unit to the neck of the room. At this point, the power is transmitted by the miner trailing cables made up of two single conductor 350,000 circular mil rubber covered cables. Equipment ground protection is maintained by a Groundicator mounted on the machine. The two separate conductor trailing cables were chosen for ease of handling, heat dissipation, and minimizing possibility of cable fires through cross conduction. The conversion units in use are a 500-kw Hewittic mercury-arc rectifier and a 500-kw Westinghouse ignitron rectifier.



Rooms are driven with the continuous mining machine on 60-ft centers, 28 ft wide to a depth of 325 ft. Roof is supported on posts and cribs



Breakthroughs are driven on a 60° angle. A 5½-man crew on the continuous mining section has averaged 472 tons per shift



The pillar is attacked in lifts parallelling the breakthroughs. By the time the boring-type machine returns to the room entrance, the next room is ready with a set-up of duplicate equipment, except for the continuous mining machine. A move can be made on shift in as little as 20 minutes

Hydraulics of Machine Are Outstanding Single Maintenance Feature

Maintenance of the machine is under the direction of the chief electrician and his assistants. Routine work is done on the machine by a mechanic in the area on both operating shifts, and a mechanic and greaser on the non-operating shift. However, in the event of a serious breakdown, all maintenance personnel are on a standby basis at the discretion of the chief electrician. The hydraulics of the machine are, by far, the outstanding single maintenance feature. With pressures averaging 2000 psi and inaccessibility of hoses and pumps, a thorough knowledge of hydraulics is necessary to do a satisfactory job of trouble shooting. In fact, a portable hydraulic tester has been incorporated to assist in checking out hydraulic circuits. To date, the machine has been a relatively low-cost unit to maintain with well over 100,000 tons produced. It is the type machine that will perform exceptionally well in average conditions for long periods of time, but because of its size and because of working under limited seam height, it becomes exceedingly difficult to approach in repairing. Nevertheless, as soon as the repairs are made, the coal begins to flow just as though a valve had been turned on.

Preparation has not been a problem. There has been a slight increase in fines and a decrease in top sizes; but with the cleaning facilities available, a satisfactory product has been maintained. However, in almost all instances of continuous miner installations, there has been a decided change in size distribution. Serious trouble can be experienced in product control unless adequate cleaning facilities are provided. This phase of a mining operation, along with other links between the face equipment and the prepared product, have been neglected in many cases, while great strides have been made with modern machines at the face. These behind-the-face bottlenecks can often result in the complete defeat of modern mining equipment. On the other hand, expenditures for equipment outby the producing areas may mean the difference between a high and low cost operation, even though low-cost continuous mining machines are the producing force.

European Mining Practices

An inspection of some major European operations revealed that there are several important practices that may have application in this country

By EDWARD P. LEACH
General Manager, Mining Division
Bethlehem Steel Co.

IN 1957, St. Joseph Lead Co. and Bethlehem Steel Co. jointly undertook development of the recently discovered body of iron ore in the Pea Ridge area of southeast Missouri. Preliminary exploration indicated that this new find might be expected to resemble, in certain aspects, some of the well-known Swedish deposits, particularly in respect to physical characteristics of the ore and its enveloping Pre-Cambrian country rock. An overly simplified description of the iron deposits visited in Sweden would call them deeply plunging, massive, lenses or veins. Pea Ridge at once differs radically from these same Swedish ores in its situation under a cover of some 1300 ft of flat lying sandstones and dolomites. Specific horizons in these sediments are known to carry large quantities of water.

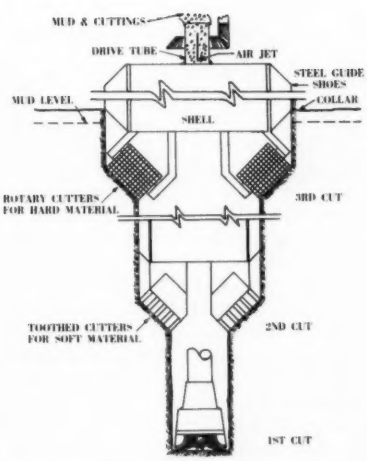


Fig. 1. Schematic arrangement of rotary boring rig used to bore a 15½-ft diam shaft at Sophia Jacoba mine in the Ruhr

Early determinations in the Pea Ridge program involved a decision to serve the ore body with two concrete-lined, circular shafts. Inevitably, the Koepe, or friction type, hoist came under consideration, and finally the possible use of wire rope guides for the shaft conveyances and counterweights.

It was natural that proposals in regard to shafts and hoisting, as well as speculations on mining plans, should draw attention to certain European mines where experience with anticipated problems is somewhat more extensive than on this continent. As a result several officials from both St. Joe and Bethlehem have made visits to England, Sweden, Germany and Holland and this article

presents a few observations which should be of interest to mining men.

Concrete Shaft Linings Employed

In English coal mines, it is usual that two shafts per mine are relied upon for service and ventilation. Shaft depths run from 1000 to 3000 ft. They do not sink special air shafts as the working face advances, as we do in our shallower coal mines. Circular, concrete-lined shafts from 20 to 24-ft in diameter are the rule for their modern developments. The large volumes of air required make a smooth, low resistance airway particularly desirable, and the obvious advantages of permanent ground support and water control are also available. In at least one of the coal mining districts, pre-freezing was found to be the most economical way of sinking through unconsolidated and water bearing strata.

The circular shaft had not been adopted at metal mines visited in Sweden. Ground and water pressures are generally no problem in their igneous rock, nor is ventilation a difficulty. Their rectangular shafts are, therefore, no larger than demanded by the traffic of men and materials. While rock and water conditions frequently required no shaft linings at all, the newer shafts at Kiruna and Malmberget are concrete lined to reduce shaft maintenance.

In Germany and Holland the newer shafts are circular and concrete lined because of the character of the ground. Rope guides are not used for two interesting reasons. For one thing, the operators are unwilling to invest in the extra space required to obtain the necessary clearance for conveyances. Secondly, it is their practice to take ground subsidence, obviously not too severe, and allow the shaft to go out of plumb. The necessary flexibility to support this subsidence condition is obtained, in the Salzgetter iron district of Germany, through the use of brick linings and wooden shaft sets. Other mines in Germany and Holland are using tubes of steel and concrete as lining for their circular shafts.

Boring an 18-Ft Diam Hole

At the Sophia Jacoba mine in the Ruhr district, a 15½ ft diam shaft was recently put down by employing a unique system for passing through soft, wet ground. (see figure 1). In this type of material the shaft advanced 1100 ft in three weeks. Sinking in solid rock continued by conventional methods to 2200 ft.

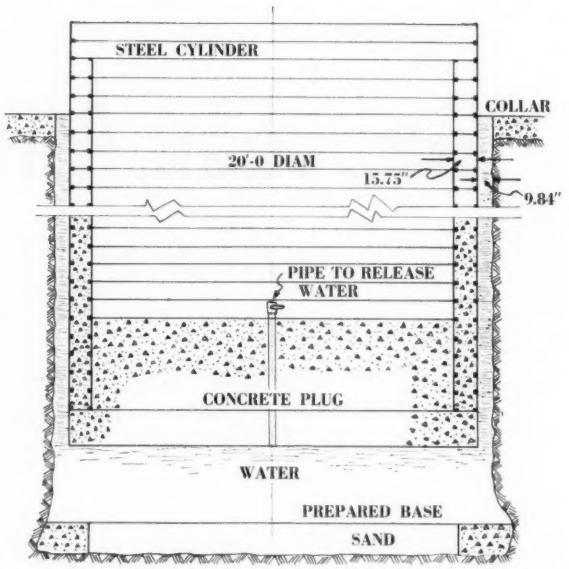


Fig. 2. Shaft lining for passing through soft, wet ground as employed in the Mart Huls shaft of Dutch State mines at Limburg, Holland

The method consists of boring and reaming the upper part of the shaft to its full diameter using a heavy duty, rotary boring rig mounted on surface over the shaft. A pilot hole is put down through the soft material to solid rock and then four progressively larger reaming tools are used to increase the diameter of the hole to approximately 18 ft. The shaft bore hole is at all times kept full of heavy media drilling mud, both to prevent caving of the sidewalls and to float cuttings to surface, where they are separated from mud and the mud returned to the bore hole.

The process of excavating the shaft follows the same technique developed for the rotary drilling of oil wells. The shaft can be completed to solid rock without a person going below surface. When the boring is completed, a concrete cup is poured to float on the surface of the heavy media in the shaft excavation. In this case the cup was 16 ft in diameter. With the concrete cup as a base, an outer and inner shell made up of rings rolled from 18 in.-wide channel is built up, with the outer shell having a 16 ft-diam and the inner shell 13½-ft diam. The space between the steel shells is filled with concrete and, as the whole unit becomes heavier, it displaces the drilling mud and sinks into the shaft, water being admitted to the inside of the cup to aid in sinking it. Additional steel rings with the concrete filling are added until the entire shaft lining has been completed and the concrete cup rests on solid rock at the bottom of the shaft. Next, the space between the outer steel shell and the shaft excavation is filled with bituminous or concrete grout from the bottom upwards, displacing the drilling mud, until the shaft is solidly anchored into the surrounding ground. Then the bottom of the cup is blasted out and sinking through solid rock continues in the conventional manner.

The cutters (on the boring and reaming tools) for hard material are very similar to those on a tri-cone rotary oil well bit. In softer going stationary toothed cutters, similar to those on a coal cutting machine, are employed. The cuttings are directed toward the center of the shaft and are carried up through the drilling stem in the heavy media solution with the assistance of an air lift. This sinking system apparently is quicker, cheaper and more simple than freezing for excavating through loose, wet ground.

In Holland this same general system has been used in ground which it was formerly considered necessary to freeze. The Dutch fill the space between the outer wall and the ground with a bituminous material in order to obtain a flexible seal. The linings are designed to bend, as a result of subsidence, some 30 in. out of plumb without breaking the steel lining. (see figure 2).

Koepe Type Hoists Popular

Modern production hoisting installations in Sweden followed the practice of underground crushing and hoisting with a Koepe type hoist mounted in a reinforced concrete headframe. Preference for the headframe mounted Koepe hoist seemed to be the rule also in Germany and Hol-

land, although the older, single rope, ground-mounted Koepe wheels are still in the majority. In England, however, while the Koepe is common, for new installations the drum hoist is chosen in the majority of cases. This preference is based largely on cost considerations. Present policy of the coal mines is to use Koepe hoists only where the depths and payloads involved are beyond the capacity of locked coil hoisting ropes on a drum hoist. This capacity is limited by rope diameter and adherence to single layer winding.

Modern Swedish Koepe installations observed were all multiple rope units. They are driven through gear reduction units by one or two d-c motors. Automatic operation was almost invariable with the skip hoist. Man and materials hoists were sometimes controlled by an attendant at the collar, when such an employe was considered necessary, regardless of the type of hoist control to be used. The English, Germans and Dutch seemed to prefer the single motion Koepe wherein the friction wheel and d-c motor, or motors, are mounted on a single shaft. Babbitted pillow blocks, rather than antifriction bearings, are the customary mountings for the single motion hoist.

While visiting Sweden, the visitors were told that two Koepe hoists were being built in that country for the Russians. Each hoist is designed to handle two 50-ton skips which will be in balance and supported by eight hoist ropes. Gear reduction units at opposite ends of each hoist drum will be driven by two d-c motors. The four motors will aggregate 9000 hp per hoist. Rope speed will reach approximately 2000 fpm.

British Prefer Locked-Coil Rope

There is an interesting difference of opinion in the European mining industry relative to the merits of locked-coil versus the more conventional hoisting ropes.

Britain's National Coal Board has, with few exceptions, specified the use of full locked coil rope on all hoists, both Koepe and drum types. Reasons for their preference are the development of greater tread pressures and less tread wear on Koepe linings, less stretch, and, in the case of drum hoists, a minimum of rotation thus reducing torsional stresses on the vehicle which tend to force the wire rope guides out of plumb.

British experience seems to question the use of locked coil rope of greater than 1⅞ in. diam. When diameters exceed this limit, unpredictable things are apt to happen including bird caging, wire breakage and crushing. Nevertheless, some larger diameter locked coil ropes are in use. Because of the danger of rope damage it has not, to date, been the practice to go to multiple layer winding although it was stated that some double layer winding installations are being considered. The law establishes a time limit on hoist rope usage up to 3½ years for drum type hoists and two years for Koepe hoists. In practice the ropes are seldom worked that long.

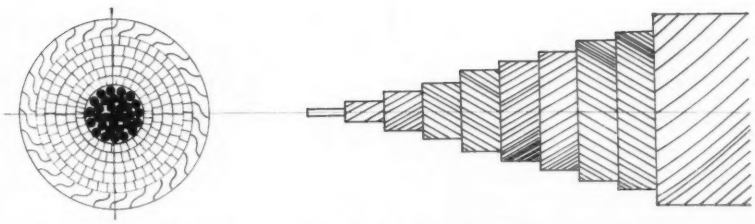


Fig. 3. Use of locked coil ropes in England is coupled with some extremely cautious standards including safety factors as high as ten

Ratio of Sheave to Rope Diameter 100 to 1

The outer casing of a locked coil rope is completely independent of the inner strands and at present it is impossible to satisfactorily determine the interior condition of a rope. (see figure 3). As a result, the use of the locked coil ropes in England is coupled with some extremely cautious standards. The ratio of sheave to rope diameter of about 100 to 1 far exceeds our usual 60 or 70 to 1 practice. Rope safety factors are customarily as high as ten and never less than six. The legal time limit on rope life has already been noted.

The enthusiasm of the English for the full locked coil hoisting rope is not shared by their fellow mine operators in Sweden, Germany and Holland. The Germans refuse to consider it because of the impossibility of determining its interior condition. The Swedish and Dutch were not so adamant but could not, on the basis of economy, justify its use. It was understood, however, that a trial installation is being considered at Kiruna and also on some new hoists for the Dutch State mines. In earlier trials at the Dutch mines, the life of locked coil rope did not approach that of standard ropes.

There is considerable variation in the type of hoist rope used outside of England. The eight hoists of the great new battery at Kiruna employ a conventional 6 by 17 round strand, Seale, Lang Lay cable—four per hoist. One of the Ruhr mines used a nonrotating, oval strand, fibre core rope as illustrated in figure 4. Another used a newly developed oval strand construction with an aluminum core in each strand. The Dutch prefer a flattened strand rope, or, in European terminology, a triangular strand rope.

Various Lagging Materials Used

Considerable investigation seems to be going on, not only to determine a suitable type of rope construction, but also to find the most desirable lagging for Koepe drums and sheaves. The British preference for the locked coil hoist rope is influenced by the greater permissible tread pressures and reduced maintenance on Koepe wheel groove linings. It has been their practice to lag the Koepe wheels with elm boards which have a comparatively short life. In all of the countries visited a number of other linings have been, or are being tried,

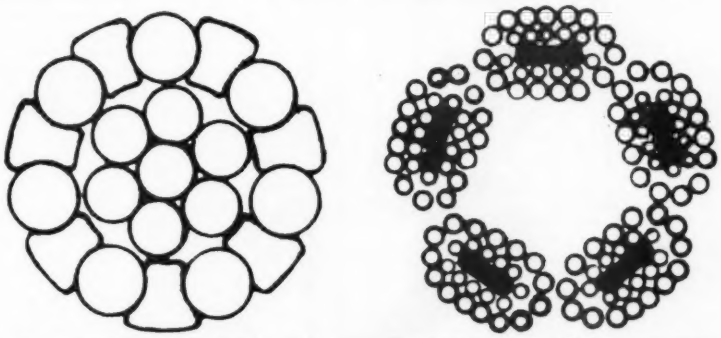


Fig. 4 (left). Half-locked 1⅝-in. guide rope and (right) oval strand 1¾-in. wire rope. Tensile strengths are 50 to 60 tons per sq. in. and 92.5 tons per sq in., respectively

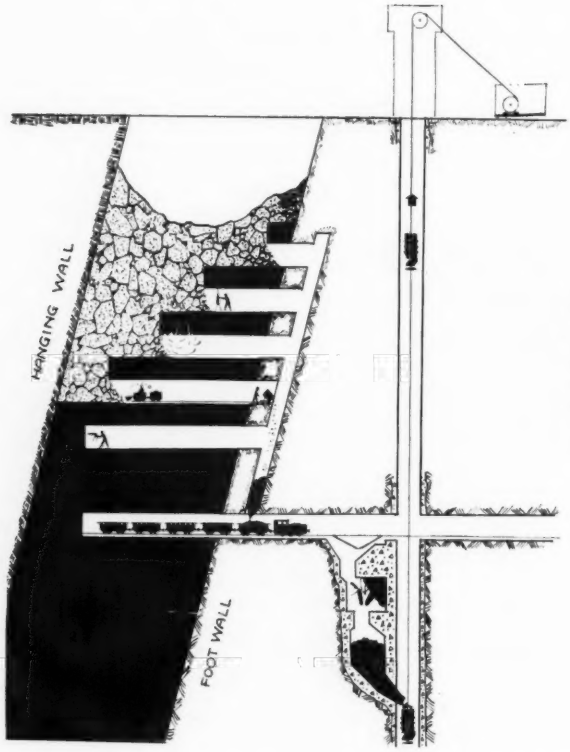


Fig. 5. Sublevel caving is the principal mining method at the Grangesberg iron mine in central Sweden. Contract miners at Grangesberg work alone and are said to prefer their independent contracts

including aluminum, leather, oak, conveyor belting stripped of its rubber cover, brake lining, etc. Encouraging results are being obtained with certain patented plastics which give a high coefficient of friction, wet or dry, and seem to hold promise of minimizing the maintenance problem.

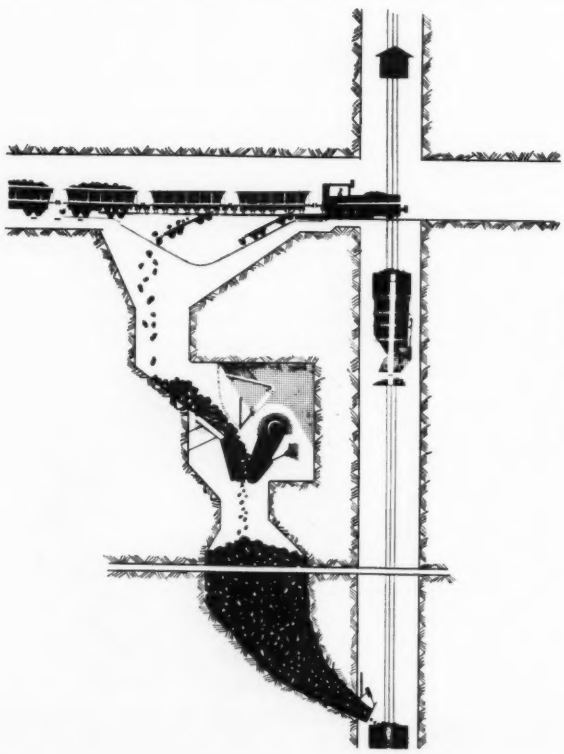


Fig. 6. Drop bottom ore cars as used at Malmberget and Grangesberg facilitate fast dumping, stay relatively clean when handling sticky ore, and are of simple, rugged, maintenance-free construction

Tail, or balance, ropes display a variety of preferences. Flat ropes seem to be the choice in Germany and Holland. Both flat and round ropes are used in Sweden and England, with the English preferring round ropes unless the distance between rope centers is too small for free looping of the needed size; then flat ropes are used. Design weight of the tail rope is usually five percent heavier per unit of length than the hoist ropes. The practice is found to give stability during acceleration and deceleration.

Practices With Wire Rope Guides

Wire rope guides have become standard practice in British coal mine shafts and are popular for their economy and ease of installation, low maintenance cost, the fact that they present a minimum resistance to air flow, and because they result in smooth conveyance operation which in turn means lower maintenance on all hoisting equipment.

One of the disadvantages in the use of wire rope guides would ordinarily be the requirement for a larger shaft to provide safe clearances between conveyances and shaft walls. In the case of the British coal mines, however, shaft size is governed by ventilation requirements and clearances happen to be no problem. Generally speaking, minimum safe clearance is considered to be 18 in. between conveyances and one ft between the corner of the conveyance and the shaft wall. There are exceptions to these figures. In a few cases, clearances down to four in. were noted but in these situations rubbing ropes were used. "Rubbing ropes" are used as buffers and to dampen oscillations but are not engaged by guide slippers on the conveyances.

An additional factor in the use of rope guides, which might be considered a disadvantage, is the necessity of sinking the shaft some 85 ft below the depth required for a conventional shaft. This must be done in order to provide space for the cast iron tensioning weights hung on the guide ropes. The weights run about one ton per 100 to 120 yards of guide length. Still another inconvenience involved with rope guides is the need for special equipment at intermediate level statons to hold conveyances steady while loading them.

Standard Size Guide Rope is 1¾ In. Diam

For rope guides and rubbing ropes, the half locked coil rope, as shown in

figure 4, is accepted because its larger wires provide greater resistance to wear and corrosion. The standard size is 1¾ in. diam, although smaller ropes are occasionally used in smaller shafts. English law dictates that guide ropes shall be changed at least every 20 years. Design factor of safety is five and the rope must be changed when the rope area is reduced to 84 percent of the original or when the safety factor drops to 4.2.

Rope guides were not employed at any of the Swedish mines visited, but it was understood they were to be tried in one of the Kiruna hoisting shafts during 1959.

The visitors to England observed that, while rope guides are now accepted practice, in those instances where stationary guides are still in use they are either steel rails or channels, in part because suitable timber is scarce. The English consider safety dogs dangerous for their hoisting speeds, which are usually around 2700 fpm but in some cases reach 6000 fpm. The dogs are not used in English coal mines and we understand their use is also being abandoned in Germany and Holland where timber guides are generally used. Safety requirements are satisfied by the adoption of conservative rules regarding rope life and safety factors.

Sublevel Caving Permits Selective Mining

The basic mining systems employed in Europe are not novel to this continent. The choice of methods and practices, as in any country, is apt to be governed by special considerations relating to the market, local customs, cost of labor and materials, etc. At Kiruna, for instance, although other methods might have application, sublevel caving is effectively employed because, for one reason, it permits selection of several different grades of ore on the basis of phosphorous content.

At the Grangesberg iron mines in Central Sweden, where again sublevel caving is practiced (see figure 5), the contract miners are a "one-man crew." The miner, working alone, does his own drilling, blasting, track laying, mucking and tramming. The seven-ft by nine-ft sublevel drifts fortunately require no timbering. Mucking is done with a small, rocker type shovel into a two-ton end dump car. Hand tramming has been eliminated by equipping the car with a small air motor. A trailing hose supplies air. The production per man has been greatly improved with the introduction of this system and the men are said to much prefer their independent contracts.

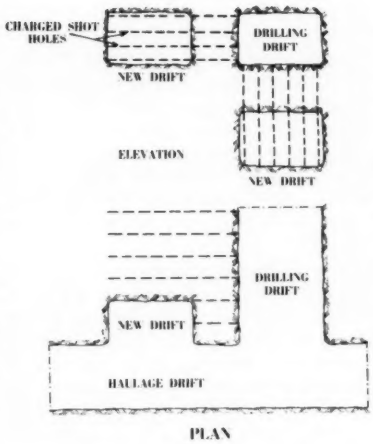


Fig. 7. Major economies are claimed in both drilling and explosives costs in drifting by the Janol method

It must be added that Grangesberg is looking for further improvement in production rates through the introduction of block caving now under trial. Their plans, however, include loading with larger rocker type shovels into 4½ ton cars at the foot of the bells. These larger, one-man cars, for tramming to the ore passes, will also be equipped with air motors.

At Malmberget and Grangesberg a drop bottom ore car has been developed which facilitates fast dumping, stays relatively clean when handling sticky ore, and is of simple, rugged, maintenance free construction. With the latest version in use at Grangesberg, the bottom door is guided through opening and closing by a roller attached to the door and traveling along a curved guide rail which dips down into the ore pocket above the crusher as shown in figure 6. A variation of this car is in use at Bethlehem's new Grace Mine in Pennsylvania. The sudden release of the load and the accompanying scouring action have proven to be the best solution yet found for the sticky, difficult ore at this mine.

New Practices Gain Acceptance

A new system of blasting, known as the Janol method (See *Engineering and Mining Journal*, July 1959) is receiving enthusiastic attention at Kiruna and other Swedish mines. It is based on the logical and commonly practiced theory that breakage is best effected by means of drill holes placed parallel to the face to be broken. To apply this idea to drift advance, however, drilling must obviously be done from a drift running parallel to that being driven as illustrated in figure 7. Major economies are claimed in drilling and explosive costs.

An interesting air receiver for storing and maintaining very large quan-

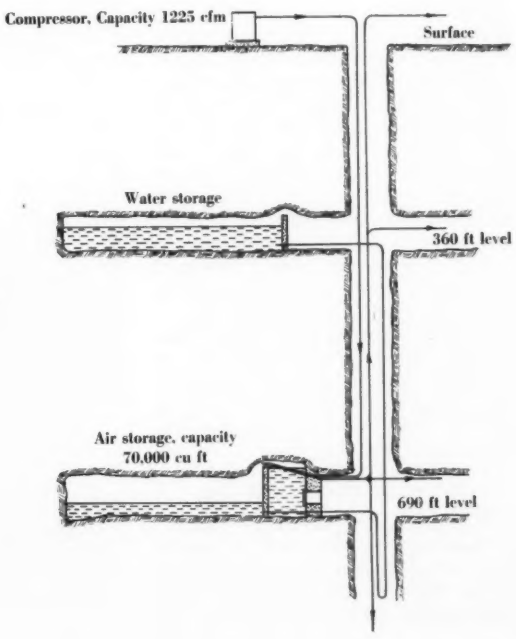


Fig. 8. Hydraulic air receiver for storing and maintaining large quantities of air at uniform pressures

tities of air at uniform pressures is in use at the Bodas mine of the Sandviken Steel Co. and is depicted in figure 8. Certain sections of this mine are devoted exclusively to the testing of the drilling equipment of one of the Swedish manufacturers.

A modernization program at the Malmberget mine has, in part, substituted the customary ore hoisting shaft with an inclined conveyor gallery carrying three flat, rubber covered, steel belts. At full production the three conveyors will transport 1500 tph. The belts travel 1500 ft up a 16½° slope at a rate of 600 fpm. Each steel belt is 28 in. wide and carries a rubber topcover 0.4 in. thick. A special problem was the design of a chute, which in profile resembles a very steep ski slide, to lay the ore on the belt at the proper velocity and angle. Among the advantages claimed for this type of belt are, of course, its high tensile strength, a substantial power saving due to less sagging between idlers, better resistance to damage with consequent lower maintenance required.

A raising device known as the Alimak elevator was attracting attention and being tried out in mines of the Boliden Co. and at Malmberget and Kiruna. A platform 5¼ ft square is mounted on sectional guide rails bolted to the rock face of the raise with expansion bolts. Air-motor driven cog wheels on the platform engage racking on the guide rails and raise or lower the platform. The guide rails carry air, water and electricity up to the drilling face. The platform itself is equipped with various safety devices including an overhead bell for protection during trimming operations, telephone communication, etc.

The foot of the raise being driven with the Alimak machine must be enlarged at the guide rail side to permit the platform to be folded back under a protecting pentice prior to blasting as shown in figure 9. Although it was stated that this device can be used in curved and inclined raises, it was seen only in vertical operations. At no place was the machine observed in a timbered raise.

Specific data on rates of advance for the Alimak elevator were not yet available, but preliminary estimates anticipated improvements of up to 50 percent over conventional raising methods.

Automatic Handling of Ore

With one exception, all modern production hoists observed in Sweden were on automatic operation. Except at the larger mines at Kiruna and Malmberget, usually one man at the shaft station tended the crusher and the skip loading installation. Two-man crews on the haulage trains spotted and loaded cars at the chutes—generally by remote control. The same crews dumped the cars at the crusher. At some of the smaller mines in Central Sweden all this was done by one man, and in one case this multi-talented individual also operated the jaw crusher.

An interesting innovation in automatic handling of ore was observed, still in process of installation, at the Langsele mine of the Boliden Co. in northern Sweden. Ore is to be trammed from a pocket below the underground jaw crusher to a shaft serving their central mill some five miles away. There will be no train crew and the entire operation of loading, tramming and dumping will be performed automatically. One of the keys to a successful automatic installation of this type, as well as in automatic hoisting, is the underground crusher and a readily flowing ore. Compared to the iron ores familiar to us in this country, the Swedish ores are fortunately hard and free from sticky fines.

Research Contributes to Practices

Visitors to mines in Sweden, England, Germany, and Holland, will be impressed with the high quality of engineering and planning that is evident throughout their operations. Aggressive programs of research and experimentation are being carried out and are contributing substantially to the practices of mining and milling. Furthermore, European operating men are well traveled and have ably adapted new developments, found anywhere in the world, to their own requirements.

Local situations and problems involving labor laws, wage scales, materials cost, tax consequences, all affect their practices just as they do on this side of the Atlantic. Performance and production rates must often be viewed in the light of these factors.

There is no question but what a great deal of mutual advantage is to be gained by frequent contacts and exchange of ideas between European and American miners. Such contacts should be encouraged and benefits can be expected to reach beyond our immediate technical interests.

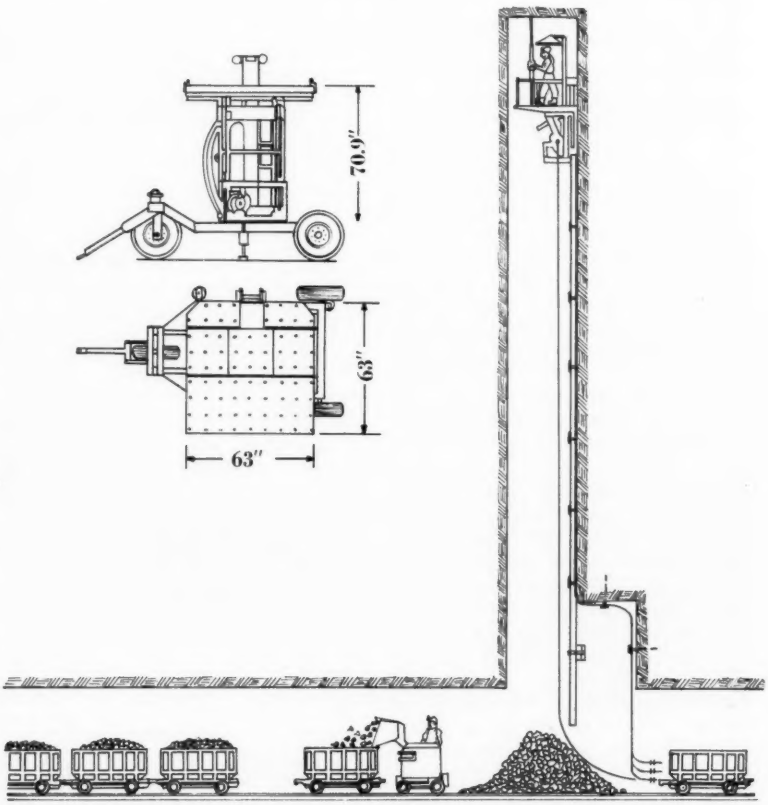


Fig. 9. Improved rates of advance over conventional raising methods are said to be achieved with a raise driving machine. The device can be used in vertical, curved and inclined raises

CONVERSION of an EXISTING MANUAL ELECTRIC HOIST to AUTOMATIC OPERATION

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Electrical Engineer
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and

W. J. McDONALD
Application Engineer
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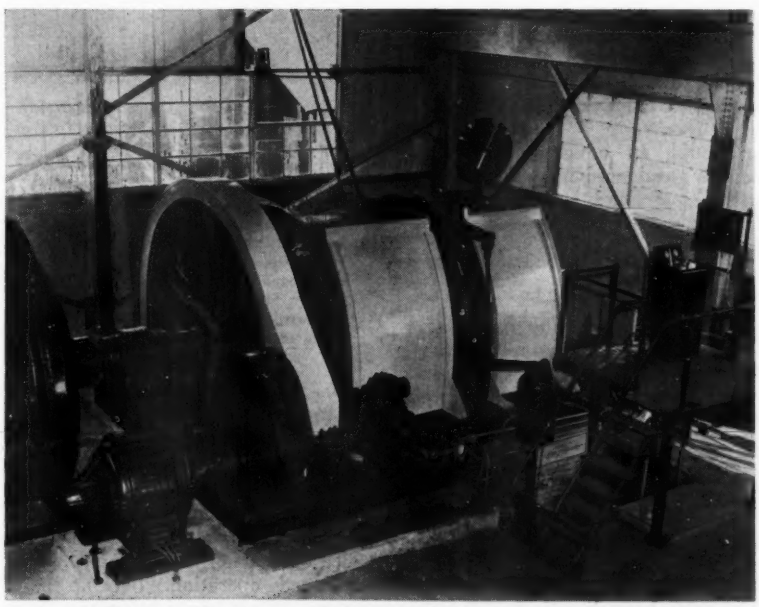
Six manshifts per day will be saved by large Illinois mine

WHEN Old Ben Coal Corporation's Mine No. 21 near Sesser, Ill., was first put on the drawing board a few years ago, thought was given to using one of two identical, manually controlled hoists that was soon to be available—one from the company's No. 8 mine, located near the south city limits of West Frankfort, Ill., and the other unit located two miles west of West Frankfort. The hoist from No. 8 was installed in the early 1920's. The other unit was installed at Old Ben's No. 15 mine in the late thirties. Three identical units were purchased in the 1920's; one of which is still in service at the company's No. 9 mine, being operated manually. The unit at No. 15 was stored for a number of years before its installation about 1940. This hoist was selected due to its being used a shorter period of time.



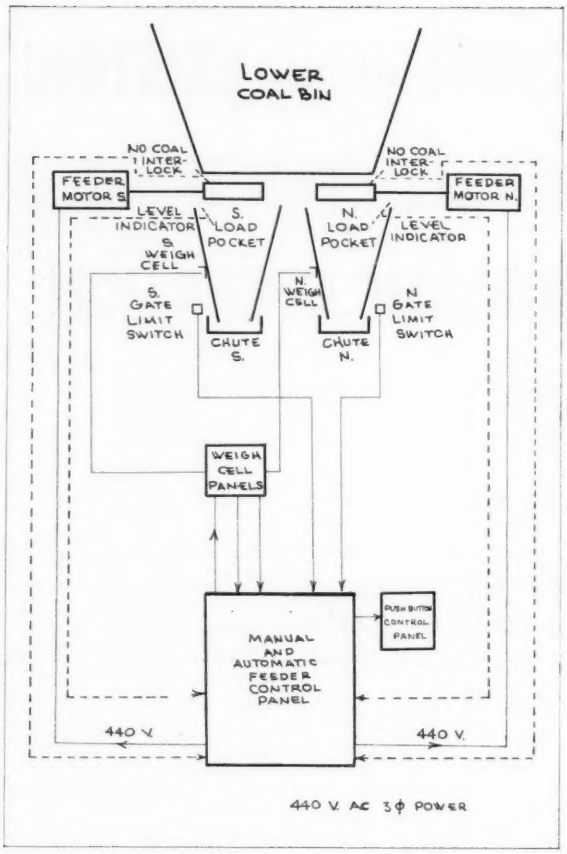
Automated hoist at No. 21 mine will raise a 48,000-lb gross load, making 80 trips per hour through a total lift of 800 ft

Dismantling was accomplished by use of a 20-ton, overhead, traveling crane that was part of the original installation. Each piece was carefully crated, skidded and hauled to the new site, about 24 miles to the north. Drums were disassembled and left at the old site. Incidentally, these old drums are now spares for the hoist at No. 9 mine, as all three of the original hoists have the same size drums, 7 by 11 ft.

Old Duty Cycle Versus New One

The old duty cycle for the manually controlled hoists was, at time of purchase, the fastest of its day. They would accelerate a 27,500-lb load in five seconds to 3800 fpm, run full speed for four seconds, decelerate in five seconds, and make 200 trips per hour with a total lift of approximately 500 ft.

The new duty cycle for this hoist will accelerate a 48,000-lb load, including skips, ropes and coal, and make 80 trips per hour with a total lift of 800 ft—the coal hoisted being



Underground loading facilities include a storage bin, two reciprocating feeders and two loading pockets with dump gates. As coal is received at the shaft bottom coal bin, automatic control equipment initiates transport of the coal from the lower bin to the surface bin. As long as coal is available, the system will continue to deliver

ten tons.

Due to the lower depth of the coal seam at No. 21 mine, new drums were needed to accommodate the longer ropes. The old drum was 7 by 11 ft cylindro-conical; the new drums are nine ft straight.

The hoist motor is rated 2200 hp, 110 rpm at 600 volts d-c. It is coupled direct to the hoist drum shaft and driven by a 1500-kw generator tied to a flywheel. The generator is driven by a 1000-hp induction, slip ring motor.

A new 600 psi hydraulic braking system was added to the new setup as a snappier brake operation was needed to bring the brake from prime-off to full-off for automatic operation.

Asbestos brake linings were added to increase brake friction by 50 percent.

The major reason for changing to an automated hoist today is pure economics. This automatic hoist and its integrated automatic underground controls can be expected to save six manshifts per 24-hour day. Three 8-hour hoisting shifts are now operating at this mine.

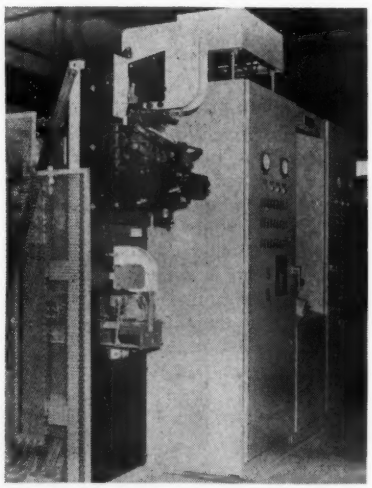
The automatic loading and hoist control equipment for the new No. 21 mine is an integrated system. That is, as coal is received at the shaft bottom coal bin, automatic control equipment initiates transport of the coal from the lower coal bin to the surface coal bin. As long as coal is available, the system will continue to deliver.

Though an integrated system, it can be considered in two parts: (1) the underground automatic loading control and (2) the automatic hoisting control.

Automatic Skip Loading

Underground loading facilities include a storage bin, two reciprocating feeders and two loading pockets with dump gates. The feeders alternately fill the two load pockets. The load pockets are alternately emptied into skips as the skips lower into the loading zone and mechanically open the load pocket gate. The gates are reclosed as the skips are hoisted to the surface.

The basic automatic control which keeps the above described cycle going is contained in a wall mounted panel. The total control included motor starters, relays, limit switches and weigh cells. The electrical control functions as follows: Assume one skip is down, the opposite load pockets are empty, coal is available and the control is set for automatic operation. The cycle is initiated by push button. The down skip load pocket feeder (north) will do nothing for its associated gate will be open. The opposite load pocket feeder (south) will start and fill the pocket. The output signal from a weigh cell, under the load pocket, will stop this feeder when the pocket is loaded. The weigh cell also initiates hoist operation. As the "down" skip moves up and closes the north load pocket gate, the north feeder fills this load pocket. At the end of the hoisting trip, the south load pocket is emptied. The feed rate of each of the reciprocating feeders has been selected to fill a load pocket in the time it takes the hoist to complete one trip. Therefore, the north load pocket will now be full and a new hoisting cycle is initiated. The cycle will continue as long as coal is available. Paddle limit switches mounted to sense the absence of coal on the feeders prevent continued operation. Back-up paddle type limit switches in the load pockets assure feeder cut off should

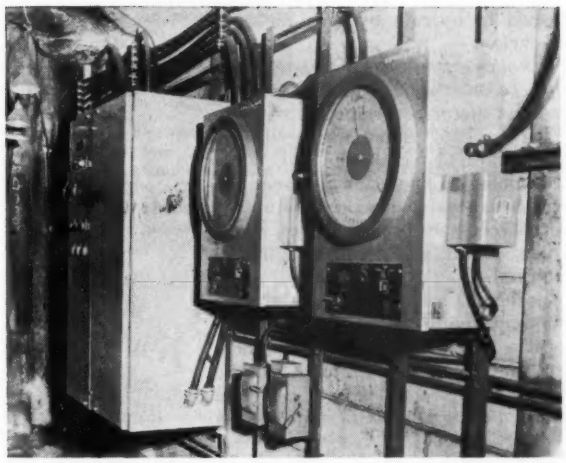


Dynamic braking and master control panel. Two modes of stopping are available. In one case, the brakes are used and the motor-generator loop is "suicided" to hold essentially zero current with the hoist at standstill. In the other case, the brakes are not used, except in an emergency. In this mode, the "stop" magnetic switches initiate a "zero" speed reference. The system decelerates to settle the skip on the loading chair. This mode of operation is preferred and is used for production hoisting

the weigh cells not function. The load pocket gate limit switches prevent a restart of the feeders and hoist to prevent dumping coal into the sump or ramming a skip into an open gate.

In other words, the underground automatic control system is sequence and safety interlocked.

For maintenance and repair purposes each of the feeder drives may be operated manually (push button).



Automatic control cabinet with weigh cell control underground

Mine Hoist Operation

The General Electric automatic mine hoist control is of the modern "Master" control type. This system does not require the usual operator's console for it was designed principally for automatic operation.

However, several modes of operation are available. These modes are referred to as (1) manual, (2) test, (3) semi-auto, (4) auto. The test, semi-auto and auto modes can further be broken down into "with brake" and "without brake" modes of operation. Selector switches mounted on the "Master" control panel make these modes of operation available.

The "Master" control panel includes a recessed operator's section with instruments and operating devices mounted for ease of operation.

Manual control is achieved with a stepless master switch. The hoist brake is controlled electrically and is so interlocked with the master switch and hoist speed that a manual brake operating lever is not required. A selsyn depth indicator and a speed indicator are mounted in the recessed operator's section.

The "test, semi-auto, and auto" modes of operation are all similar. The "test" mode of operation allows push button initiation of a single trip from the "master" control panel. The "semi-auto" mode of operation allows initiation of a single trip from the underground load pocket control station. The "auto" mode of operation allows initiation of continued cycles from the underground automatic skip loading control.

Mine Hoist Control

The basic portions of the control may be broken down into three categories. These are (1) regulators, (2) programming and (3) safety provisions.

Regulator. The regulators for this d-c adjustable speed drive include high performance speed and current limit regulator. High gain, fast-response push-pull amplistats, multifield amplidyne and high accuracy tachometer are used to attain high performance. Such a system assures that the hoist system will hold reference speed regardless of load, under current limit, and is not sensitive to changes in motor field current or changes in machine heating.

The current limit regulator is a sharp cut-off type regulator which limits the current and torque the drive is called upon to supply.

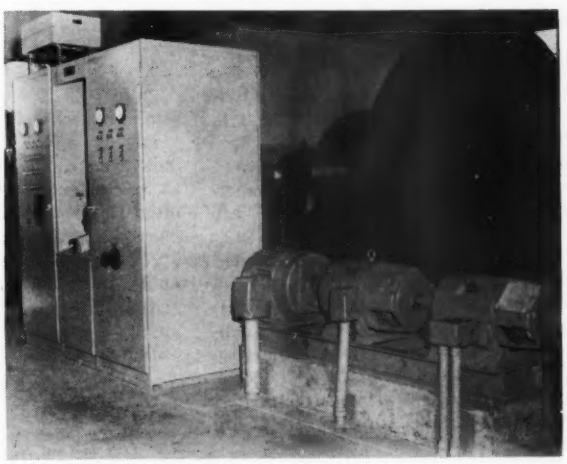
Programming. In the "test, semi-auto and auto" mode of operation, the hoist follows a definite programmed cycle. The skip speed is limited at both ends of travel because of mechanical engagements. Therefore, the hoist cycle includes the following:

(1) Accelerate to creep speed.
(2) Run at creep speed a short distance.
(3) Accelerate to full speed.
(4) Run at full speed a prescribed distance.
(5) Decelerate to creep speed.
(6) Run at creep speed a short distance.
(7) Stop.

To achieve the above described hoist cycle, several equipments are used. The main programming device, normally called a QC switch, is a gear driven speed reference. This unit includes "tumblers" to attain accurate shaft distance representation, slowdown cams and a stepless speed reference. The cams are cut on a "square law" function to produce linear speed acceleration and deceleration profiles.

A constant radius at the end of the cams sets the creep speed reference. Under loaded conditions the hoist accelerates on current limit and decelerates on the cams. Under lightly loaded conditions, the hoist accelerates and decelerates on the cam.

To initiate final stop, magnetic limit switches are used. They are mounted in the head frame and are



Master control panel and amplidyne generator. One of the more important features of the hoist control is terminal slowdown "back-up". That is, when the hoist is operated manually, the programming gear speed reference over-rides the manually controlled speed reference and forces the system to slow down at the ends of travel

caused to operate by skip mounted magnets.

Two modes of stopping are available. In one case, the brakes are used and the motor-generator loop is suicided to hold essentially zero current with the hoist at standstill. When this mode of operation is used, the brakes are primed as a function of hoist creep speed. This assures quick brake action when full braking is required.

In the second mode of programmed stopping, the brakes are not used, except in an emergency. In this mode, the "stop" magnetic switches initiate a "zero" speed reference. The system decelerates to settle the skip on the loading chair. This mode of operation is preferred and is used for production hoisting.

Safety. One of the more important safety features of the hoist control is terminal slowdown "back-up". That is, when the hoist is operated manually, the programming gear speed reference overrides the manually controlled speed reference and forces the system to slow down at the ends of travel.

A second important function is timed over-current detection. Should current in excess of that required to hoist a loaded skip at full speed exist for a longer period than the normal acceleration time, the hoist is emergency-stopped.

Other safety functions include detection of the following: motor field loss, generator over-current, generator circuit ground, generator over-voltage, d-c and a-c control power under-voltage, exciter set motor power loss, main MG set power loss, bearing heating, hoist over-speed, skip over-travel, slack rope and program gear loss.

To prevent over-filling of the surface coal bin, the hoist is interlocked to prevent restarting until the bin level is sufficiently low to receive skips of coal.

The brake mode selector switch is so interlocked that selective release of the brakes is permitted only with the hoist at standstill in hoist modes of "test, semi-auto and auto".

All control stations have emergency-stop pushbuttons which are available at all times.

A "hold" feature is incorporated in the remote control stations (head frame, washer house, and underground) so that hoisting can be temporarily halted, without otherwise disturbing the hoisting control. Lights indicate at all control stations when the "hold" function is being used.

Roof Control

SUPPLEMENTARY TIMBERING*

FALLS of coal from the roof, face, and ribs continue to be the largest cause of fatal accidents in bituminous coal mines. In 1958, these falls accounted for 176 deaths, or approximately 56 percent of all deaths in coal mine accidents—in spite of the fact that we have the know-how to control this hazard.

Ninety-five percent of the mines in which these fatalities occurred had timbering plans. But in 50 percent of the accidents, it was found that the timbering plan was not being complied with!

Although there is no exact figure available giving a reason for the rest of the roof fall deaths, it is believed that many can be attributed to another cause —the lack of supplementary timbering. These are the cases where the adopted timbering system was used, but was not enough to meet unusual roof conditions in the mining operation.

It must be always kept in mind that all timbering systems are minimum requirements and are designed to meet normal roof conditions. They are arrived at after careful study of roof conditions as they prevail generally throughout the mine. They are based on a certain width of room or entry. For instance, a roof-bolting plan for rooms 20 ft in width may require four roof bolts to be placed on four-ft centers across the place. If the place is widened for any reason, this minimum bolting system will no longer be sufficient. Additional bolts will have to be provided, or posts will have to be set to allow for this increased width.

Further, visual inspection may show indications of the presence of a slip or a "kettle bottom." "Sounding" a roof often will verify the presence of these unusual conditions, and additional support should be provided at these locations. "Sounding" should be a constant and routine operation. Where "sounding" the roof indicates a "drummy" condition, it means the roof is loose and should be taken down. The roof above the removed material should then be immediately sounded and, if loose, the necessary steps to make it safe must be taken.

It might be concluded from the large number of roof fall accidents that men just don't like to set enough timbers for safety. Any feeling that timbering is "dead work" and not productive is certainly wrong. We all know that when a roof falls, regardless of whether or not an injury results, much production time is wasted. It takes more production time to clear the debris of a fall than to properly secure the roof in the first place. If roof must be taken down in a place for safety reasons, the loading cycle often can be varied in advance so there is no loss of production time. But should the roof fall unexpectedly, the cycle is disrupted without any chance for advance planning, and usually production time is lost. *There is no sound reason for not making roof safe!* Sometimes, when improperly secured roof is found, the miner or supervisor says he has been "keeping his eye on it." The impression is that one can observe and tell just *when* the roof is going to fall. If there were any merit to this type of roof control, experience would make a man's powers of observation keener, and we would find the less experienced or the younger employes getting hurt. But records over the past five or six years indicate that this is not true. The average age for men killed in roof fall accidents during that period was 43 years. These men had from 18 to 22 years' work experience!

Since there can be no easy way to solve the problem, there is but one alternative. That is to do the job right, right away. Short-cuts produce nothing but accidents and lost production time.

An approved timbering plan should be followed. It should be remembered that a timbering plan provides minimum requirements and is intended for normal conditions only. Where changes occur due to the mining operations, or to abnormal roof conditions, then additional support must be provided promptly, or the loose roof taken down.

** Prepared by the Advisory Committee 1960 National Campaign to Prevent Injuries from Roof Falls in Coal Mines.*

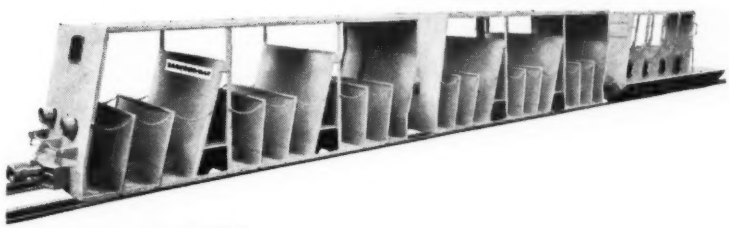
Have an Un-Safe haulage problem? The S-D Brakeman* could be your solution!

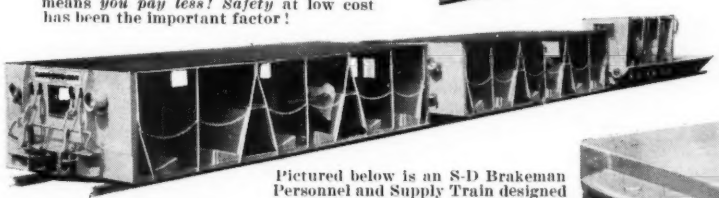
We have developed a special safety car called S-D Brakeman. It incorporates electrically operated magnetic brake shoes. Here are but a few S-D Brakeman and S-D Brakeman Personnel and Supply Trains we have engineered and built to solve particular *safety* problems. S-D Brakeman safety control cars can be designed for use with mine or railway cars to solve any number of problems at low cost — underground . . . mainline . . . tipples, etc. Write us today for BULLETIN A400. It fully illustrates in six pages many types of S-D Brakeman Cars with specifications and complete information. *Sanford-Day Iron Works, Inc., P.O. Box 1511 . . . Telephone 3-4191, Knoxville, Tenn.*

The problem this customer had was with potential break-aways when pulling upgrade on a long uphill haul. This S-D Brakeman *replaced a locomotive and operator* used to tag along behind trip as a safety measure. Controls are set on this 8-wheel S-D Brakeman for a predetermined speed, which, if exceeded, will automatically apply the brakes.

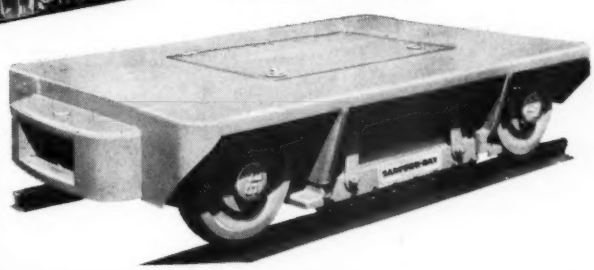
This customer needed cars to transport personnel. Train was to operate by cable on 16 degree slope. *Safe* transportation was the first and foremost consideration. Second important factor was to obtain this safety at *low cost!* An S-D Brakeman was the solution. Not only did it serve as the *safety control car* for the trip, but itself became a dual-purpose man and supply car. Therefore, it further operates independently transporting supplies and maintenance personnel.

Another customer needed an S-D Brakeman Personnel and Supply Train. In his case, however, underground haulageway required low-height train. The two S-D Man Cars are uncoupled from S-D Brakeman at bottom of slope and coupled to conventional locomotive which transports men to working areas. You will note neither design has costly streamlined construction. They are compact all-steel functional units with each steel member an integral part of the frame work. Result: Minimum manufacturing cost which means *you pay less! Safety* at low cost has been the important factor!





Below is another type S-D Brakeman frequently ordered to replace locomotive used in trips for braking.



Pictured below is an S-D Brakeman Personnel and Supply Train designed and built to operate on 17 degree slope by hoist-cable. Note S-D Brakeman was built with material-handling platform to be *level* when transporting supplies on the sloping haulageway. At a pre-determined setting the *revolution of the wheel* applies the *brake shoes.*

SANFORD-DAY
KNOXVILLE, TENNESSEE

To: Sanford-Day, 612 Dale Avenue, Knoxville, Tenn.
Gentlemen, please send by return mail CAR BULLETIN A400 with specifications, data and fully illustrating S-D Brakeman Cars

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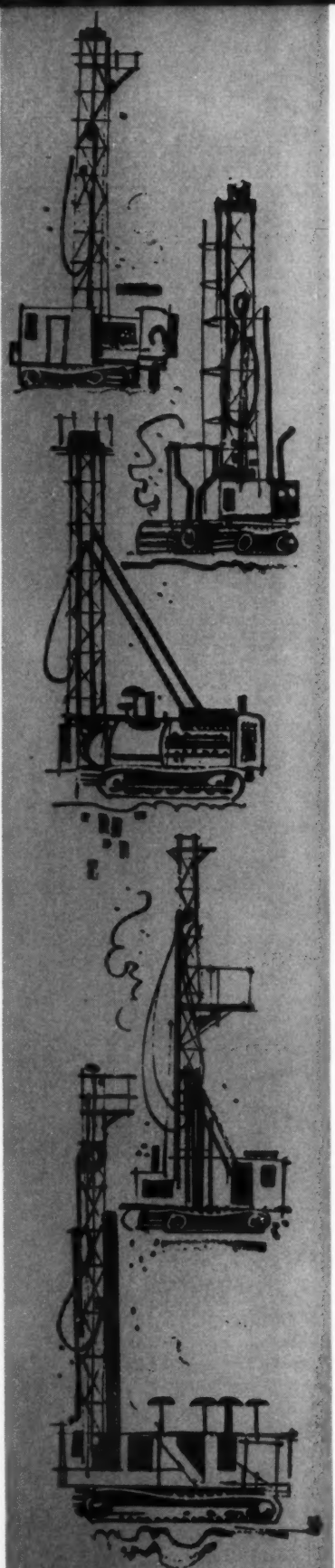

HUGHES "Rota-Blast" Bits

Hughes "ROTA-BLAST" RG-2JS Mining Bit—Instead of conventional teeth, this bit has sintered tungsten carbide inserts combined in a special process with alloy steel cones. They provide maximum resistance to wear in the hardest and most abrasive formations. Inserts in the gage surfaces of the cones reduce gage wear and increase the cutting efficiency of the bit. Inserts on the bit legs eliminate the problem of body wear.

Hughes "ROTA-BLAST" bits – Engineered for Mining

RG-2JS
For extremely hard abrasive rock (Taconite, quartzite)

W7R
For hard rock (Siliceous limestone, dolomite, sandstone, granite)

OW
For medium rock (Limestone, sandstone, sandy shales)

are Engineered for MINING

This is the Hughes "Rota-Blast" RG-2JS rock bit . . . proved superior in the Mesabi Iron Range, toughest of all blast-hole drilling. The RG-2JS rock bit is a direct result of Hughes Tool Company research in co-operation with drill manufacturers and mine operators.

In the extremely hard, abrasive taconite in the Mesabi Iron Range, steel tooth bits drilled from 5 to 20 feet. The RG-2JS "ROTA-BLAST" consistently makes 500 to 800 feet of hole per bit in the same type of rock.

Research that developed the RG-2JS is going into the complete line of "ROTA-BLAST" bits, engineered specifically for rotary blast-hole drilling. The "ROTA-BLAST" line includes a full range of sizes and types.

Your Hughes Representative can recommend the bit that will deliver the best performance in drilling every type of rock. And behind his recommendation and behind every Hughes bit is more than a half-century of rock bit experience plus the world's largest rock bit research laboratory and manufacturing plant.

OSC-1G
For soft formations
(Calcite, shale, clay)

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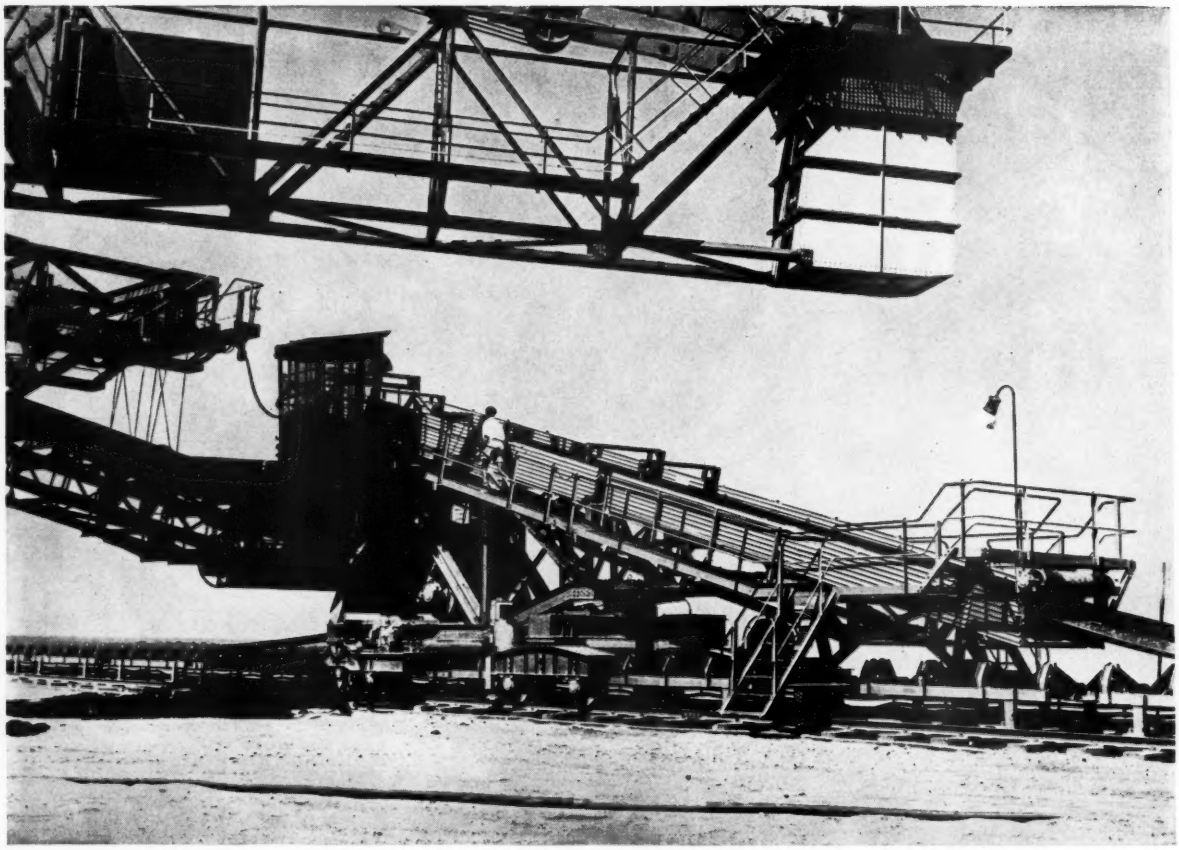
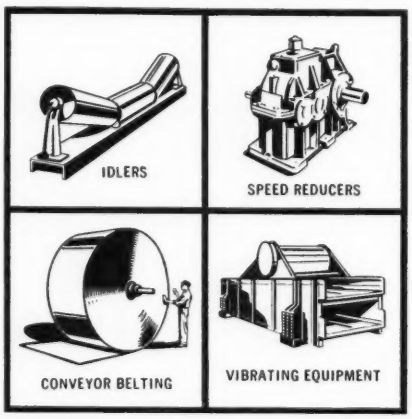


IN AFRICA, TOO,

H-R Conveyors Handle Overburden



Conveying 3000 tons of overburden every hour from the Nchanga Copper Mine in Northern Rhodesia is the grueling task of this 7400-ft. Hewitt-Robins conveyor system. A key unit in this operation at one of the world's richest copper mines is an H-R tripper that:

- Feeds overburden from conveyor to stacker.
- Interlocks with stacker to insure combined movement.
- Travels under its own power when dump conveyor is moved.
- Is engineered to withstand heavy loading, continuous runs.

The superb engineering and workmanship that go into Hewitt-Robins trippers are found in all H-R conveying equipment. For full details consult your H-R representative, or write Hewitt-Robins, Stamford, Connecticut. Ask for Bulletin 6-15.

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ECONOMICS OF EQUIPMENT REPLACEMENT IN THE MINING INDUSTRY

By F. G. KUEHL
Vice President
International Talc Co., Inc.

"Pay-out time" for new equipment is of prime importance in determining if a machine should be replaced. The author analyzes the factors to be considered before making a new installation, and proposes a simple method for calculating the annual return on investment

A recurring problem, with which the engineer and management must cope, is the replacement of a given piece of machinery that has outlived its usefulness. Among the reasons for possible replacement are: obsolescence, a higher unit output or a lower labor cost with a new machine, and/or excessive maintenance cost for the old unit or a higher operating cost due to excessive down time.

Factors To Consider

In considering the merits of an investment of this type, taxes, interest, depreciation, salvage value and insurance are among the factors that should be considered.

State and Federal Income Taxes and Real Estate Taxes. In line with a company's tax structure, a potential saving in operating costs could be reduced by as much as 50 percent by federal taxes alone, and in those states where an income tax is imposed the saving would obviously be decreased further. However, because of depletion or percentage depletion the federal tax on the other hand could be as low as 23 percent. For the purpose of this analysis, the combined state and federal taxes will be assumed to amount to 33 percent.

Real estate taxes may become significant if a tax is imposed upon installed machinery or if the new installation requires an additional building or a building extension. In New York State, in general, there is no tax on machinery, since this is considered to be "personal property"; but buildings (in our area) have a tax rate of $60 per thousand dollars of assessment with the assessment taken at 62 percent of the appraised value.

Interest. Interest on the first cost of an installation is sometimes neglected, but should be included since it is obvious that if it were necessary to borrow money or to issue bonds, interest of, say, five percent would have to be paid. Again, assuming that the working capital of a company were adequate to pay for such an installation, this charge is still valid since this money otherwise could be used in the business or invested elsewhere and could earn, at the present time at least, a relatively high rate of interest. For the purpose of this analysis a rate of six percent will be used.

Depreciation. From among the several methods of calculating depreciation, for purposes of this article the straight line method has been chosen, and the life of the machine will be assumed to be 12 years. Therefore, there will be a charge of 8½ percent per year in equal annual increments over the life of the machine.

Salvage Value. In some instances the salvage value of a machine being replaced is substantially junk value, but it is conceivable that a machine may become obsolete after one or two years operation, and in the latter event this becomes significant. Salvage value will be used as a credit toward the cost of a new machine since, in general, the old machine is sold and the proceeds (less tax) could be used to offset the cost of the new equipment. It should not be forgotten at this point that we should take a net salvage cost subtracting from the proceeds the actual cost of removing the old machine.

Insurance. Insurance costs could conceivably be much higher on a new and more expensive piece of machinery and will be included in this analysis.

Cost Analysis Includes Fringe Benefits

It must be known or estimated what saving could be gained by replacing a given machine, of course. The saving could be affected by using a machine that would have a lower operating cost due to higher capacity, a lower maintenance cost or less labor might be required to operate it. It is in order to add here that fringe costs should be included in analyzing any labor costs, since published data indicate that these are as high as 63 cents per hour per man. When it is considered that perhaps twenty years ago the hourly wages of some of the labor in our area was just 60 cents per hour, the significance of these fringes can readily be seen.

The various data can now be put together in order to determine the so-called "pay-out time"—the number of years that it will take to pay the original investment on the new machine. Company policy will dictate the maximum time limit and while three years has been set as a maximum "pay-out time" by some companies, perhaps five years is more realistic. Some people like to have their answer in the form of a percentage return on the investment. The writer has not gone into further reinvestment on the savings which would, of course, reduce the "pay-out time" still further.

Examples of Pay Out Time Calculations

In a certain crushing plant one of the crushers has a high maintenance cost. This crusher has been in operation seven years and for the past two years the maintenance cost has been $7500 per year. It is estimated that these costs will not increase over the next few years. It is proposed to substitute another crusher with substantially the same capacity which would cost $26,000 installed and have an estimated maintenance cost of $1000 per year. The net salvage value before taxes of the present crusher is $1200. This installation would not require

any additional building.

A quick analysis of the above would indicate that a $6500 saving per year for an expenditure of $26,000 would make for a four-year "pay-out time." This is erroneous as the following analysis will indicate.

Cost of Installation	**$26,000**
Salvage Value After Taxes ($1200 – $400)	**800**
Net	**$25,200**
Interest on $25,200 @ 6%	**1,512**
Depreciation on $25,200 @ 8½%	**2,142**
Insurance on $25,200 @ 1%	**252**
Total Fixed Charges	**$ 3,906**
Net saving (Maintenance) ($7500 – $1000)	**6,500**
Total Fixed Charges	**3,906**
Net Saving Before Taxes	**$ 2,594**
Saving After Taxes ($2594 – (.33 × $2594) and Annual Return	**$ 1,738**

"Pay-out time" will be 14.5 years and return on investment only 6.9 percent. Obviously this proposal is not acceptable and management would not consider the installation.

A second proposal, however, was suggested and this involved the purchase of a somewhat larger unit, which if installed would increase the capacity of the plant to such an extent that one operating shift could be eliminated. In this fashion a saving of $16,000 annually in labor could be effected. The estimated maintenance cost, however, would be the same as in the preceding crusher but there would be an additional $500 annual power cost for this unit. The cost of this installation would be $34,500 and no additional building would be required. Let us analyze this proposal:

Cost of Installation	**$34,500**
Salvage Value (Net)	**800**
	$33,700
Interest on $33,700 @ 6%	**2,025**
Depreciation on $33,700 @ 8½%	**2,869**
Insurance on $33,700 @ 1%	**338**
Total Fixed Charges	**$ 5,232**
Net Saving Maintenance	**6,500**
Saving Labor (shift)	**16,000**
Total Gross Saving	**$22,500**
Less Increased Power Cost	**500**
Net Saving	**$22,000**
Reduce By Fixed Charges	**$ 5,232**
Net Saving Before Taxes	**$16,768**
Saving after Taxes $16,768 – (0.33 × $16,768) and Annual Return	**$11,179**

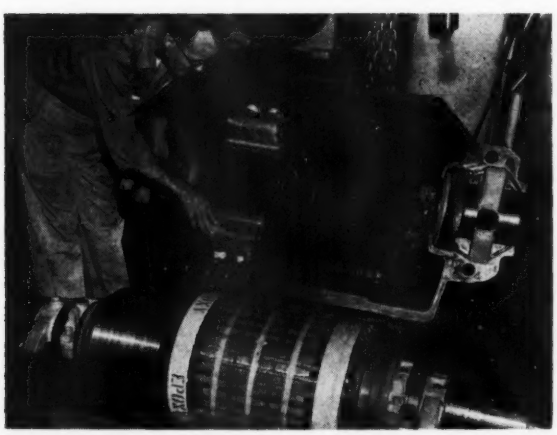
"Pay-out time" would be 3.0 years and return on investment 33.2 percent.

A paper presented at the spring meeting of the AMC Committee on Strip Mining covers maintenance of electrical rotating equipment and spotlights the role of some of the new materials, such as epoxy resins and polyesters, in reducing maintenance and increasing service life of equipment

MAINTAINING MOTORS and GENERATORS USED in OPEN PIT OPERATION

By J. O. SHERRARD
Electrical Engineer
National Electric Coil Division
McGraw Edison Co.

Wound rotor banded with glass tape. The bands have high arc resistance and are unaffected by continuous operating temperatures up to 150° C



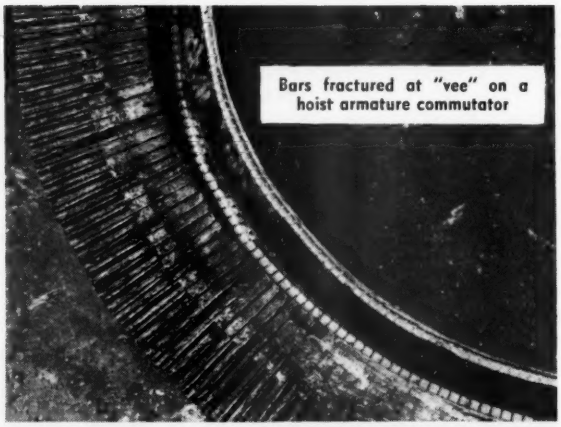
Shovel - type motor has epoxy - treated armature and field coils, and the armature is banded with glass tape. Development of epoxy resins and polyesters has led to a new concept for insulation of electrical rotating machines

BEFORE discussing the subject of maintaining motors and generators, the word "maintain" should be defined as it applies to the industry. Broadly, "maintain", according to Webster, is: (1) to hold or keep in any particular state or condition; (2) especially in a state of efficiency.

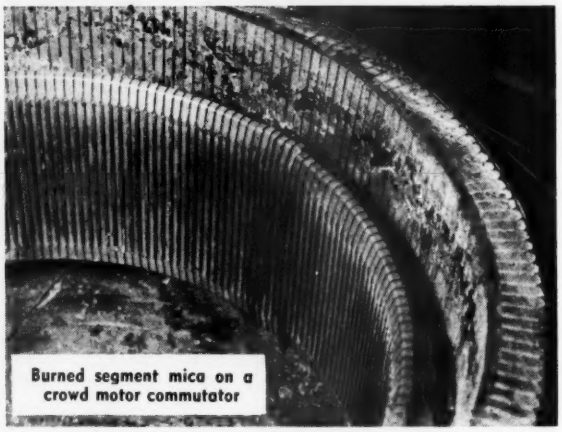
Efficiency, as the design engineer interprets it, is the ratio of output to input, and with the type of materials available at the time of design, mechanical and electrical losses of motors and generators are the lowest, consistent of course with space requirements, a balanced design, and practical manufacturing tolerances.

Operating men, however, must use another definition for the word efficiency—namely, "the capacity to produce desired results." They know the results which are expected of them: produce a quality product at a reasonable cost.

Three views show typical commutator failures caused by overspeed and extreme temperatures when using conventional shellac-bonded mica. Later developments have made it possible to use Alkyd Vinyl segment mica and mica "vee" rings—material that withstands higher temperatures


Bars fractured at "vee" on a hoist armature commutator


Broken bars on a hoist armature commutator


Burned segment mica on a crowd motor commutator

Let us now review for a moment the first part of the definition for "maintain." The statement, "to hold or keep in any particular state or condition," puts the problem squarely up to management. Note the word "any."

A company must first decide what state or condition it is to hold and plan its maintenance program on that basis. Of course, the ideal plan, based on the designers' interpretation, would be to keep all equipment in a state of efficiency equal to that of new apparatus, but this would not be an economically sound standard. The company must therefore decide what percentage of its gross revenue can be allocated for maintenance and then determine from experience how best to use the funds to minimize down-time.

The second part of the definition for "maintain" refers to efficiency which, for the purpose of this discussion, has been chosen to mean capacity to produce. Ability to produce depends directly upon the percentage of time the equipment is ready to go, which could well be termed "percent availability." For the highest percentage, utilization of the company's maintenance allotment must be wisely administered.

Types of Maintenance

Care of motors and generators will not be the same for all industries and is dependent upon the type of industry and the application.

Industrial equipment is generally accepted to mean motors and generators used in manufacturing processes and the duty is less demanding. Steel mill equipment, however, is subject to harder usage and consequently is of more rugged design requiring a greater expenditure of maintenance dollars. Railway motors and generators in turn need closer and more complete maintenance supervision to realize a high "percent availability" factor.

Equipment for use in open pit mining operation is patterned in most part from experience gained in steel mills and on railroads. More rugged initial designs are needed and because of the heavy duty application, planned procedures of maintenance are essential.

Another factor affecting a company's planning is the age of the equipment, since in many cases materials are being used today which were not available to designers ten or even five years ago. Some of the materials can be used to recondition existing equipment before it fails and thereby add new life and reduce the possibility of service breakdown necessitating emergency repair. A program of planning should be pointed toward the complete elimination of "emergency," which is costly.

Inspection

Naturally there are many items, which require periodic inspection, that are common to all industries but the frequency of checking will vary widely.

Insulation resistance of fields and armature windings should be measured with a good megger and readings recorded at least monthly.

Brushes and brush holders should be checked weekly. Raise and lower the brushes in their boxes to free any dirt which could cause them to stick. Proper brush spring tension should

be maintained at all times and insulators kept clean. Remove brushes which are too short and always use grades recommended.

Bearings and gear center distances should be kept within recommended permissible operating tolerances, bearing in mind the close relation between mechanical and electrical maintenance. Bad bearings, a bent shaft, carbon brushes stuck in their holders, or improper brush holder spring tension are some of the possible mechanical defects within a motor itself which can cause an electrical failure. Then, too, an extra load imposed on a motor by mechanical binding external to it may overload the motor to a point where failure of the winding results.

Commutators and the area adjacent to them are a potential source of failure, primarily because of possible accumulation of conducting dirt or carbon dust. Insulation on the front "vee" ring should be kept clean and any sign of grease or oil leakage from bearings must be investigated and corrective steps taken. Loose or worn bearings and overgreasing are possible sources of trouble. The most vulnerable spot on generator armatures of open riser type commutators is the rear "vee" ring and front coil support which is between the "vee" ring and the core.

New Materials

Earlier, the possibility of using new materials to recondition existing equipment was mentioned. These materials are being used industry-wide in new motors and generators, and in many cases lend themselves remarkably well to the overhaul of existing equipment without replacing electrical windings.

Resins. These new materials are epoxy resins and polyesters; their development by the plastics industry has led to a new concept for insulation of electrical rotating machines. Epoxy resins used to insulate diesel locomotive motors and generators have done an outstanding job under extremely severe operating conditions. Temperatures can range from well below freezing, when starting, to in excess of 180°C in the windings due to sustained overloads. Vibration and overspeed are also adverse factors and the operation atmosphere is usually contaminated with moisture, oil, and dirt.

The value attached to the use of these new resins can best be understood by the fact that manufacturers confidently expect to attain winding life of ten times that which was considered normal a few years ago. Epoxy resins are particularly useful for winding protection of electrical motors and generators because they are solventless with no by-product given off during curing, which makes them ideal for vacuum impregnation of coils or complete motor and generator components.

Curing of the resins is effected by adding a catalyst or curing agent. This produces a solid material which can be made to have a wide variety of physical and electrical properties, depending upon the particular type of resin and the curing agent employed. By the use of various curing agents and modifiers, epoxies can be formed in a range from a water-thin liquid to a thermoplastic solid. They can be made to cure rapidly at room or oven temperatures depending upon their intended application.

Other modifications are possible by adding fillers such as silica flour, glass fibers, or aluminum oxides. When used in the proper amounts these fillers reduce the coefficient of thermal expansion, increase the thermal conductivity, and minimize shrinkage during curing. One of the early uses of epoxy resins was to bond glass-insulated wires in revolving field coils of synchronous motors and it was only natural that their use was extended to impregnate mica-taped field coils. The next step was to develop them for armature coils and for complete armature vacuum impregnation.

The new result has been to attain:

1. High thermal stability
2. High thermal conductivity for cooler operation
3. Chemical inertness to moisture, acids, alkalies, lubricants, diesel fuels, and solvents—particularly chlorinated solvents commonly used for degreasing and maintenance cleaning

The techniques developed for diesel locomotive traction motors and diesel generators have now been applied to steel mill motors and open pit shovel rotating apparatus. The effectiveness of epoxy resins as an impregnant can best be illustrated by the fact that it is common to test field coils by applying a 1000-volt d-c test to the coils while immersed in water. Wound armatures have been tested at 1000 volts d-c while in water to one in. below the commutator neck for a period of weeks with no appreciable change in insulation resistance from the one minute reading.

About a year ago the idea was advanced to impregnate old armatures in epoxy to rejuvenate the windings and dozens of such armatures are in service and their performance is being carefully watched. Some, even with loose or partially missing commutator mica, were vacuum impregnated—commutator and all. The performance to date is very gratifying and the indicated results provoke the thought that the same procedure could be profitably applied to open-pit shovel armatures on a planned removal from service program before failure.

Glass Banding Tape. For more than a year wire bands on armatures have been replaced by glass bands in many cases. The banding tape used is not woven but has its high tensile yarns laid parallel, and they are bonded with fully catalyzed thermosetting polyester resins. The tape is itself an insulation and molds readily to the armature coil configuration, and thus becomes practically a part of the coil system. The bands have high arc resistance and are superior for heat exchange, resulting in cooler windings. They are unaffected by continuous operating temperatures up to 150°C. Their use has gone a long way in eliminating flash-overs. Glass bands can be applied to armatures without removing the old winding.

Commutator Mica and Copper. It would be folly to develop a super insulation system for the electrical coils in d-c equipment and leave a weak link. Commutators too must be improved. Manufacturers now use silver bearing copper for the bars which increases the mechanical strength and raises the annealing temperature. The segment and vee ring mica is no longer shellac-bonded, but instead an alkyd vinyl bonding agent is used. These refinements are of utmost importance on hoist and crowd motor armatures. When new windings are installed in generators with open commutator risers, the rear vee rings and coil supports are carefully insulated with a catalyzed compound to provide surfaces to which a minimum amount of dirt will adhere. The outboard or front "vee" ring is treated in a like manner on all motors and generators.

Maintenance could be compared to the circumference of a circle. It has no end. In our task of meeting production demands and keeping our equipment at a high "percent availability" factor, maintenance is a continuous procedure. The relation between mechanical and electrical maintenance is such, that to say "mechanical maintenance ends here and electrical maintenance starts" is just as illogical as to say "the circle starts here and ends there."

By FRANCIS L. HOLDERREED
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and
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Efficient control of the flotation process for a particular mill run demanded that the operator have instantaneous assay information — a condition which could not be met with conventional sample collection and preparation methods. What could be simpler than monitoring an already existing pulp sample immediately by x-ray?

X-Ray Analytical Methods IN PROCESS CONTROL

ASSAYING is the bane of many a mill man's existence. On one hand he stands or falls on the assay evidence of his operation; on the other hand the evidence is always in the nature of a post-mortem report. The mill operator has only a single chance to make the desired mineral separation—while the minerals are in his circuit. Anything said or done afterward may affect his job, and his company's financial position, but no amount of talk will change the degree of metallurgical control practiced in the concentrator's flotation circuit.

A crying need of the operator is to have some facts in time to do something about his process problems—not blame for what he did when he was, metallurgically speaking, flying by dead reckoning. One way by which the Anaconda mill man is being armed with the instantaneous assay information required for intelligent operator decisions is the technique of x-ray fluorescent spectrographic analyses.

Three Copper Ores Blended

A brief review of the background situation in the Anaconda copper concentrator may be of interest. Whereas previously separate flotation flowsheets had been provided for each of the three characteristically different Butte copper ores, changing economic conditions demanded a blended, single, ore feed throughout the mill. This meant that a single flotation flowsheet had to adequately recover the diverse copper minerals, many of which occur in a persistent and intimate association with pyrite.

In the course of developments, the installation of a new multi-stage flotation circuit resulted in a greater degree of control over the grade of copper in the final concentrates, still maintaining a respectable recovery.

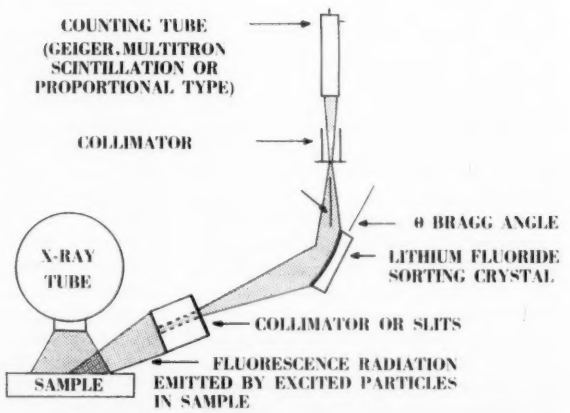


Fig. 1. Schematic drawing of major components involved in an x-ray fluorescent spectrograph

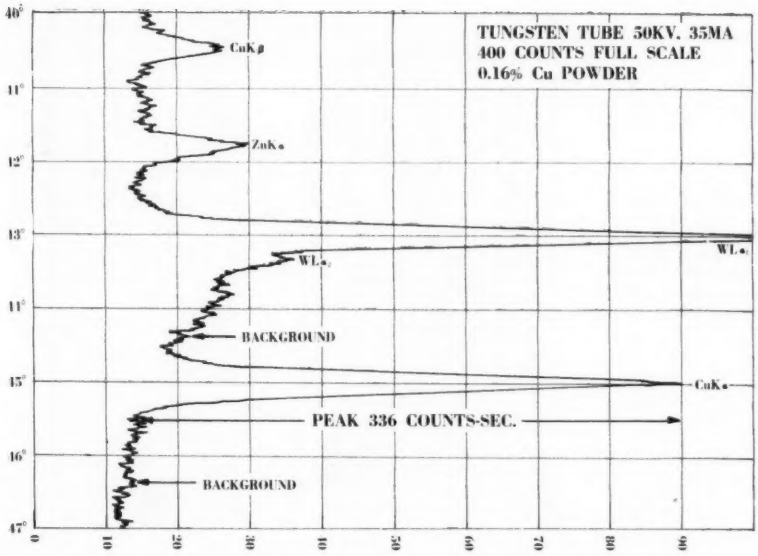


Fig. 2. Example of tracing produced from x-ray spectrographic examination of a copper sample. The height of the copper K-alpha (Cu K α) peak is a function of the strength of copper excitation, and therefore the quantity of copper in the sample

In the first stage of this circuit a major separation of copper and gangue was made in the bulk float with a moderate primary grind. The bulk tailing was final. After regrinding the bulk concentrate to further liberate copper mineral, a two-stage cleaning section separated the permissible final concentrate from the middling particle. The final, scavenging, section aimed to recover only the middling copper from the previously liberated pyrite and gangue for retreatment and recycling to the cleaners. The scavenger tailing also was final.

In such a flowsheet note that only a single separation function was performed in a given section of the flowsheet. Recycling of intermediates was reduced to a minimum and restricted to a flowsheet section which could not affect the major separation of copper from gangue.

In spite of the advantages of this step-wise division of work the operator still had but a single opportunity to perform the desired recovery function. More than ever before he suffered from a lack of assay information. Formerly he had a passing interest in a high plant tailing assay it is true, but he would not worry overly much about any instantaneous or "slop" assay for the simple reason he never knew the cause, which might be refractory ore or a natural sloughing of a circulating load which finally had exceeded the physical capacity of the circuit. As a result he tended to pay relatively more attention to the copper assay of final concentrates, in deference to the smelterman's complaints about grade, rather than to the company's basic need for maximum recovery at grade.

Standard Assay Techniques Too Slow

In the new circuit, when he needed to keep both grade and recovery constantly in mind, the operator sorely needed at least three assays (bulk tails, scavenger tails and final concentrates) because these were final products leaving his plant. For purposes of control he was also interested in two others (ore and bulk concentrates) because they were the input to two of his major circuits. In such a situation the customary acquisition of shift pulp-samples, which were filtered and assayed only on day shift, were useful for a metallurgical history but useless for process control. Hourly samples of pulp were noticeably more timely but they were still 1½ to 2 hours into history by the time chemical assays were available. They were, therefore, of poor information value in the knowledgeable control of the flotation process. Veteran mill men will appreciate, furthermore, that the sampling and analytical crew required to provide such a suite of assays from a number of mill sections might easily approach if not equal the mill operating staff. Anaconda could ill afford such a large scale non-productive, even if interesting, activity.

Utilization of the well known x-ray spectrographic technique seemed to offer the most likely solution to the assay time-problem. The research department had previously demonstrated the possible advantages and some of the pitfalls of x-ray method of copper analyses on dried concentrator products. With finely ground and thoroughly mixed solid samples, a copper assay of metallurgical accounting-quality could be achieved in an assay time ranging from two to five minutes. Necessary precautions included the use of carefully prepared standard samples, which had previously been assayed by chemical methods, and a thoroughly reproducible manipulative technique by both the instrument and its operator.

X-Ray Method Explained

A quick review of the basic x-ray principles is relevant to the remainder of this article. Figure 1 schematically represents the major components involved in an x-ray fluorescent spectrograph:

Under suitable current conditions the target of an x-ray tube emits a beam of high intensity x-rays.

These primary x-rays fall onto the sample to be assayed and, within the energy limits of the primary x-rays, excite the atoms of the various elements in the sample. In turn these excited atoms emit (or fluoresce) secondary x-rays, each element at a wave-length characteristics of that element; for example copper, iron, sulfur, or silica in the present discussion.

A selected portion of the secondary x-ray beam is caused to fall upon a diffraction

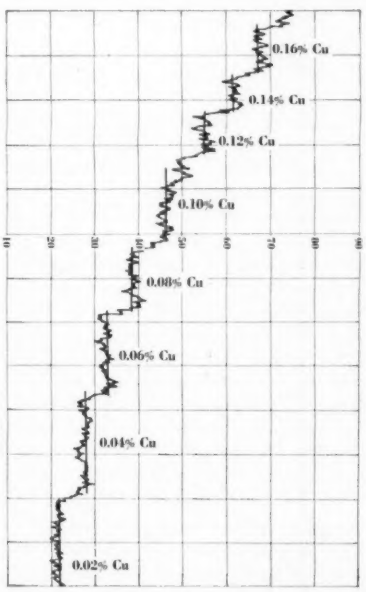


Fig. 3. Tracing of peak intensity levels with increasing copper concentration in a water and barren quartz mixture

crystal by means of collimator, slit or similar device. The function of the crystal is to sort out and pass only the energy beam of interest, for example, copper.

This "sorted" or diffracted beam is caused to enter a suitable detector where the fluorescent energy is measured.

Theory shows that the energy intensity of the diffracted beam of secondary x-rays is proportional to the quantity of element in the sample. It is no great problem, therefore, to determine the copper in an unknown sample if the energy read-outs of similar known, or standard, samples are available: the copper concentrations will be proportional to the strength of the fluoresced and diffracted beam of x-rays. In figure 2, for a typical example, the height of the copper K-Alpha peak is a function of the strength of the copper excitation, and therefore of the quantity of copper in the sample.

Obviously, the graphic portrayal of the peak intensity (voltage) is more of a laboratory than an operating plant technique. In the latter case, and in the remainder of this article, the energy intensity will be determined at the peak, that is, at the two θ (theta) degree setting of the crystal.

In either case, however, some attention must be given to the height of the background "noise" (including scattered background radiation) being generated within the electrical circuitry. Four rough assay determinations the absolute peak values may suffice, but better quality assays are derived by either the technique of ratio of peak to background, or the net peak after subtracting background. Inspection of the tracing in figure 2 demonstrates one of the handicaps in the latter technique for the energy level of the background on one side of the copper peak is different than on the other.

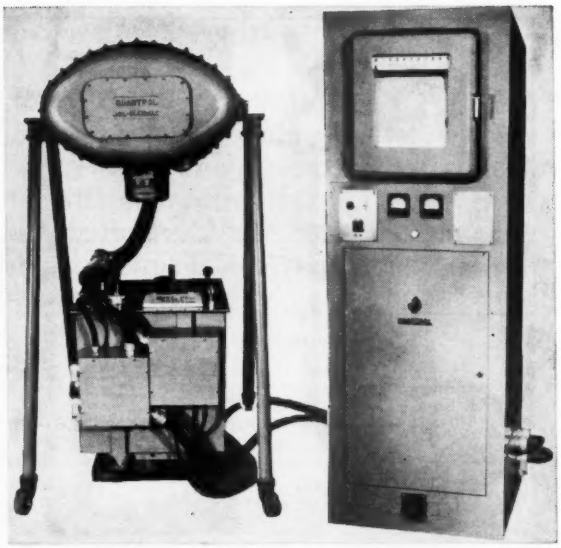


Fig. 5. Basic monitoring equipment includes the x-ray chamber, power source and recording console

Unknown Sample Must be Similar to Standard

A further requirement of high quality assays by the x-ray method is maintaining a matrix in the unknown similar to the matrix in the known or standard samples. In copper concentrator assaying the ratio of copper to iron is important because the iron atoms in the irradiated sample will absorb some of the fluoresced secondary copper radiation. When this happens, the energy read-out for the copper contained is less than for a similar quantity of copper either in some non-absorbing matrix or in pure copper minerals alone. For this reason care must be taken to compare to, or standardize against, samples of common family background, for instance, tailings with tailings but not with centrates or copper foil.

While the x-ray method required only a couple of minutes to assay a given sample, a practical in-plant test during the summer of 1957 demonstrated that sample collection and preparation time was unchanged and so long that process control was impossible by even x-ray methods of assaying dry solid samples.

The realization finally dawned that all previous thinking about sample preparation had been in a rut. The pulp stream in any flotation circuit is the ultimate in samples. The prevailing turbulence guarantees a random distribution of solid particles. Over the years much effort, in time and money, has been expended to reliably remove a representative cut, or sample portion of this process stream. Long association made a mental block of the sample bucket wherein the pulp is collected for eventual processing in filters, dryers, bucking room and rolling cloth. For process control purposes what could be simpler than monitoring an already existing pulp sample immediately by x-ray? The surface of such a sample presentation could be exactly reproduced. Likewise

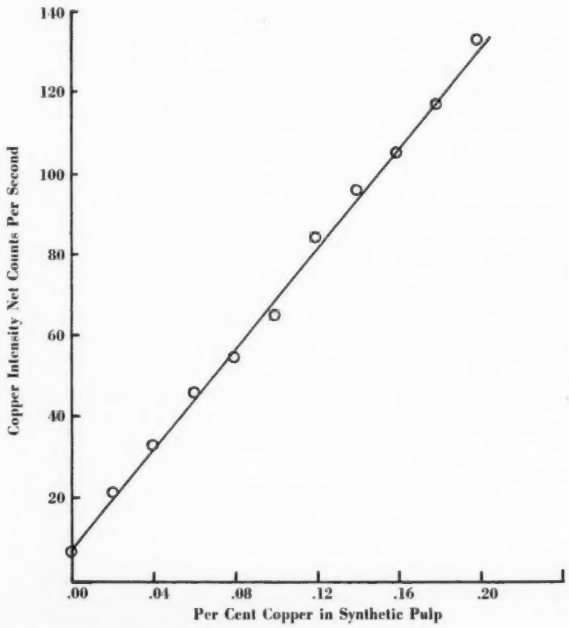


Fig. 4. Graphic representation of change in copper assay in a synthetic pulp with energy counts per second. The pulp was made by the addition of final concentrate to water

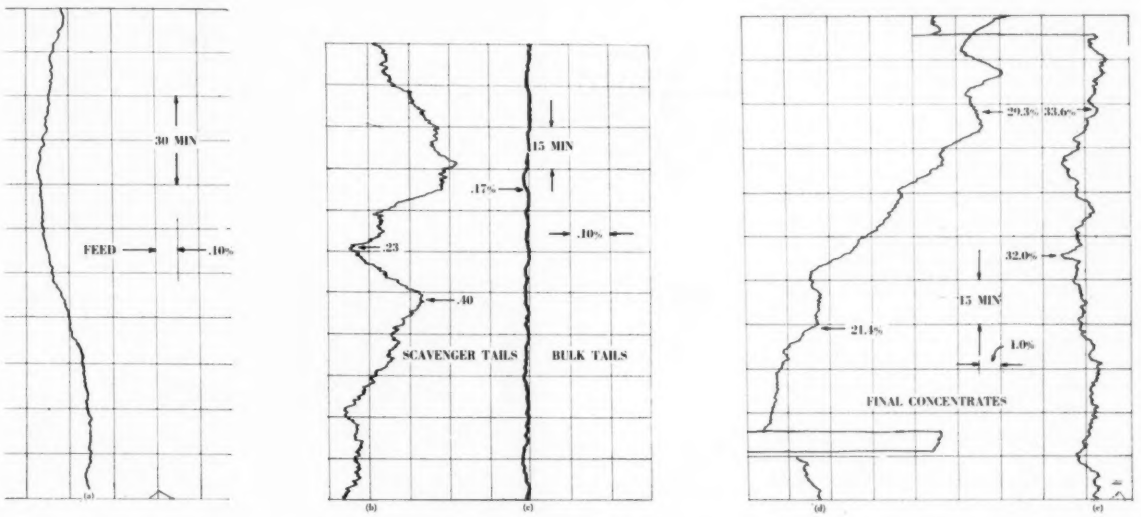


Fig. 6. Tracings represent typical raw assays in the flotation circuit: (a) ore feed to flotation, (b) scavenger tailings showing a previously undetected but persistent cycling caused by the circuit's alternate loading and unloading of middling materials, (c) bulk tailings under even operating conditions and stable controls, (d) final concentrates, (e) final concentrates under "normal" conditions

the distribution of solids could be controlled at the surface being irradiated by the primary x-ray beam.

Laboratory Tests Were Successful

An evaluation of the idea of monitoring pulp samples was made by pumping various synthetic pulps through a plastic sample cell in the excitation chamber of the department's laboratory type x-ray spectrograph. Figure 3 shows the peak intensity levels of a series of increasing copper concentrations starting with water and barren quartz (at constant dilution). Figure 4 shows the same information in a more useful graphical form, that is, the change of copper assay with energy counts per second.

Further successful demonstration of the technique soon followed by pumping various pulps from the department's eight in. (cell size) flotation pilot plant through the sample cell in the x-ray machine. The results showed that the x-ray method could be used for process control and that high quality assays required taking into account pulp density variations. Thus, by the end of the summer of 1958, the research staff had concluded that the x-ray method of monitoring pulps for copper content was ready for an in-plant test.

After rechecking equipment available from the major suppliers, arrangements were made with the Applied Research Laboratories to convert one of their standard model Quantrol x-ray units to monitoring various concentrator pulp streams. The basic equipment received on December 31, 1958 may be seen in figure 5. During the test period, which ended July 31, 1959, the Quantrol chamber went through a series of evolutionary changes of physical position, and minor changes in optics.

In-Plant Monitoring Problems

Most of the test effort involved the integrity of the pulp sample being monitored by the x-ray. Transporting small sample streams of pulp across a large concentrator posed several problems not encountered in the research building experiment where most of the pipe runs were downgrade, and where the pipe very conveniently happened to be plastic tubing. Another difficulty not encountered in the pilot plant was wood fibers, which proved to be a real problem with certain mill samples when the pulp stream finally entered the ¼ in. rubber or plastic hose leading to the sample cell.

In handling pulp samples containing flotation reagents, pains had to be taken to prevent air bubbles being included in the monitored pulp stream: otherwise a froth flotation action caused a concentration of copper minerals into the accidental froth and led to amazing, if erroneous, assays which were either high or low depending on the location of the froth with respect to the monitored surface of the pulp. In certain cell configurations and positions, interference of eddy currents within the sample cell resulted in a quiescent pool where solid particles congregated—to the impairment of the assay, of course. Some plastic materials were prone to hold oily type flotation reagents with attendant buildup of microscopically fine air bubbles (and a mineral flotation problem again) or to hold micaceous flakes by a kind of oil-smear action.

In the end a useful, dependable technique was established which continuously yielded reliable assay information. Conventionally available primary sampling equipment in the mill section permitted transport of the pulp sample stream in one in. standard pipe. Vibrating screens removed wood fibers. Further reductions in pulp volumes were made by two successive stages of inexpensive wig-wag cutters so that the presented sample flowed at negligible head through a ¼ in. rubber or plastic tubing to the sample cell. Pulp density was determined on pulp emerging from the sample cell and conventional samples were either mechanically or manually cut from this stream for check assays by chemical methods.

The energy read-out of the Quantrol's geiger tube detectors was reproduced on a strip chart as a continuous tracing. Typical or significant raw assays, that is, not corrected for density variations from pre-standardized

conditions, may be seen in figures 6(a) through 6(e). Note especially figure 6(d). The shift operator involved hurriedly disappeared when he saw the low copper grade. That he "did something" about it is self evident. An alert management is bound to ask what relevant conclutions could be drawn from the usual shift assay in this particular case. Obviously any such averaged assay value would be not only meaningless but actually misleading. In figure 6(e), what the operator termed "normal" may have been true, but the production certainly was not at, nor always close to, the shifts average assay.

Table 1 shows certain comparisons of x-ray and chemical assays. For this type of comparison the average x-ray value was usually estimated visually from the pen tracings over the sample period. A planimeter could have been used for more accurate averaging.

Table 1. X-Ray performance assay comparisons on various mill products with chemical method assays

	Percent Copper		
	X-Ray on Continuous Pulp	Wet Method (1)	Check Assay (2)
West Mill Bulk Tails #3			
9 days (3 shifts/day)	0.15	0.16	
5 days	0.17	0.16	0.16
4 days	0.17	0.16	
4 days	0.17	0.16	
West Mill Scavenger Tails			
5 days (3 shifts/day)	0.35	0.48	0.52
4 days	0.49	0.55	
4 days	0.53	0.54	
4 days	0.50	0.50	
East Mill #1 Final Concts.			
6 days (3 shifts/day)	26.8	27.1	
East Mill Feed			
3 days	1.00	0.98	

(1) Concentrator control determinations on hourly pulp samples filtered, dried and assayed by KI (potassium iodide) method for copper.

(2) Check assay on identical solids used by concentrator's control laboratory, also KI method.

Table 2 gives correction values applied to the raw x-ray assay read-out for pulp density variations from the previously standardized conditions.

Table 2. Copper assay corrections for pulp density variations

Product	Standardized % Solids in Pulp	% Cu Assay Correction* Per 1% Solids Change
Bulk Tailing	25	0.007
Scavenger Tailing	10	0.07
Final Concentrates	25	0.4
Ore Feed	25	0.03

**Apply as a positive correction for pulps having a pulp density lower than standardized conditions, and negative for those having a higher pulp density.*

Sequential Monitoring of Samples

While the early intention had been to constantly monitor only a single pulp stream for assay information, experience indicated that continuous monitoring might not be required of all of the previously mentioned pulps under normal or stable mill conditions. If certain of these pulps could be sequentially monitored by a single x-ray machine there would be a considerable reduction in equipment costs. A pair of sequencing valve units may be seen in figure 7, which were used to alternately pass bulk tailings and either scavenger tailings or final concentrates through the sample cell (figure 8).

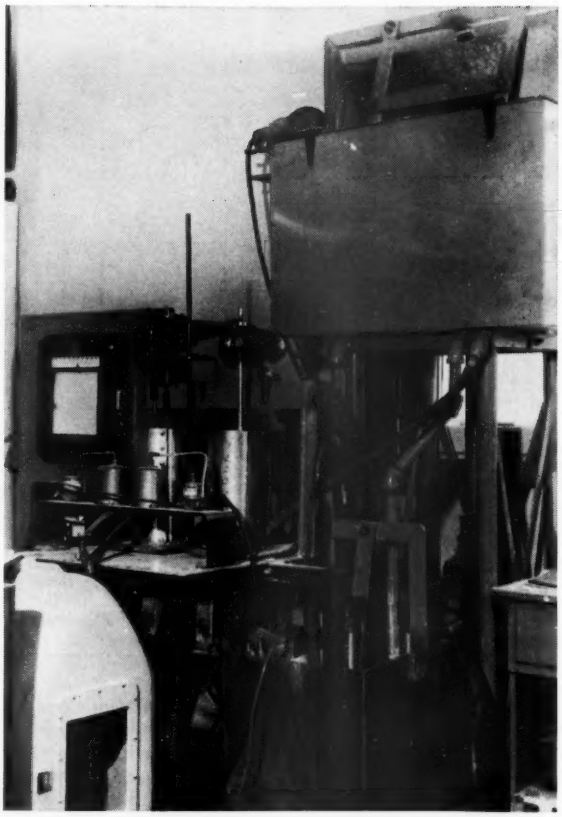


Fig. 7. Sequencing valve units permit monitoring of several pulps with a single x-ray machine, thereby minimizing equipment costs

A flushing time of one minute sufficed to flush the cell and prevent contamination of bulk tailings even by final concentrates as can be observed in a tracing of figure 9. The total

(Continued on page 103)

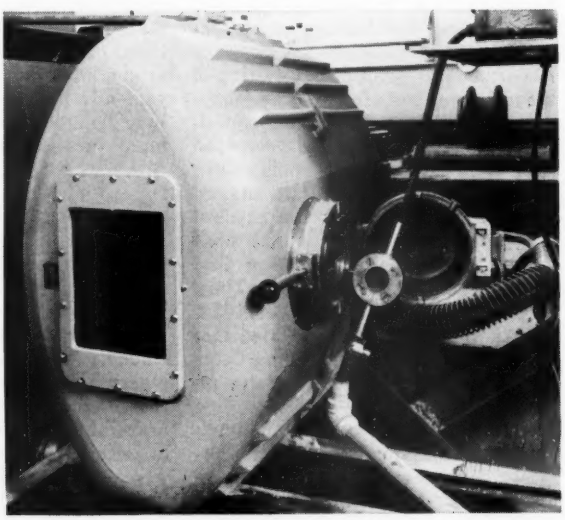


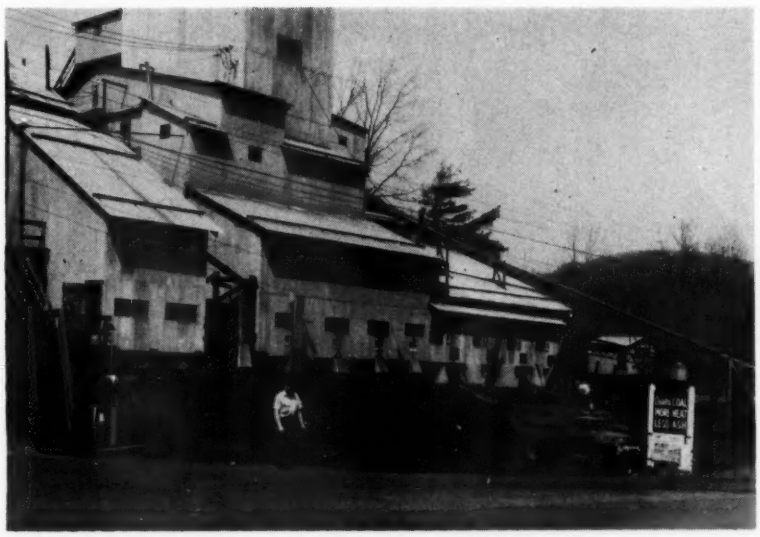
Fig. 8. General appearance of pulp sample cell

What's NEW

in Anthracite Preparation

Application of a totally automatic density control robot for modern dense media systems offers almost unlimited opportunities for increasing management's control over production standards

By J. E. IPPOLITI
Chief Engineer
Wilmot Engineering Co.



The trend is toward better preparation of anthracite coal, due to competition, consumer demand and the urge for lower preparation costs

THERE is no question but that present day thought is veering strongly toward better preparation of anthracite coal, due to competition, consumer demand and the urge for lower preparation costs.

Since the introduction and the now excellent acceptance of the dense media process for quality control of both coarse and fine coals, there is a relentless interest by preparation engineers and manufacturers of coal preparation equipment in improving quality and sharply reducing product cost.

Latest Innovation—Automatic Density Control Robot

The latest innovation to solve product quality and reduce product cost is the recent introduction of a totally automatic density control robot for modern dense media systems.

Basic principle revolves around the use of gamma radiation emitted from radiation isotopes.

The AccuRay density measuring head, mounted on the dense media pipe just ahead of the manifold leading to the dense media vessel, measures density of the flowing media by radiation absorption. The amount of radiation passing from the radiation source to the radiation detector is inversely proportional to the mass or density of the product in its path. The radiation detector allows an electrical current to flow which is proportional to the density of the medium. This current is fed to a preamplifier, then to an AccuRay density instrument, with a visual indicator, where a d-c output of minus 5 to 0 to plus 5 millivolts is produced. This output goes to a Honeywell Electronik circular chart recorder-controller which employs a graduated chart to suit specific gravity readings, graduated to read directly to 0.001 specific gravity.

Electronik instrument has an Electr-O-Line proportioning control unit which operates two final control elements:

(1) A motorized valve in the media bypass line.
(2) A modutrol motor operates a rheostat on the magnetite feeder and regulates or adjusts the rate of feed to the system.

The Electronik controller throttles the flow of medium in the bypass valve line and also increases or decreases the frequency of the dry magnetite feeder in direct proportion to the amount of deviation from the preset point of specific gravity. This controller has a second control unit, connected to a motorized water valve, which opens to admit more water to

the system, should the specific gravity of the medium get too high. The control system employs AccuRay level detectors directly mounted on the sides of the main medium sump. On low-to-normal level the AccuRay level system causes a second motorized water valve to open or close. Should the sump level get too high, the AccuRay level system opens the medium bypass valve wide and the medium bypasses to the washings sump and thence to the magnetic separator.

To further insure complete automation and exact specific gravity control there is a controlling ammeter which measures current drawn by the main feed conveyor drive motor. When the current drops below a set value, which indicates no load on the coal feed conveyor, the magnetite feeder stops, allowing no additional magnetite to be introduced into the separatory system. Inasmuch as the coal feed has stopped, no coal feed moisture is entering the system and thus no magnetite is required.

Method Insures Quality Coal, Reduces Coal Losses

This method of automatic controls will maintain the specific gravity in the separatory system at the optimum value, insuring the most efficient separation of the refuse and coal. It not only insures quality coal, but reduces losses of coal rejected with refuse and losses of magnetite due to irregular feed and occasional sump overflows and spillages. Above all, the method eliminates the human element and one's inability to cope, instantaneously, with the system's irregularities. Erroneous specific gravity readings. or sampling always result in material losses and poor quality of product. This is usually followed with loss in production and a resulting high unit cost. By use of recording instrumentation and automatic controls, the human element and error is eliminated and an actual existing record and optimum value of specific gravity is constantly maintained. Knowledge gained by study of recorded charts substantially aids in explaining and in planning corrective measures for ideal preparation of a quality product and in making corrections of operating inefficiencies.

Application of this system offers almost unlimited opportunities for increasing management's control over production standards. Better control can mean greater yields, higher production rates, better and more uniform quality product and, consequently, greater profits.

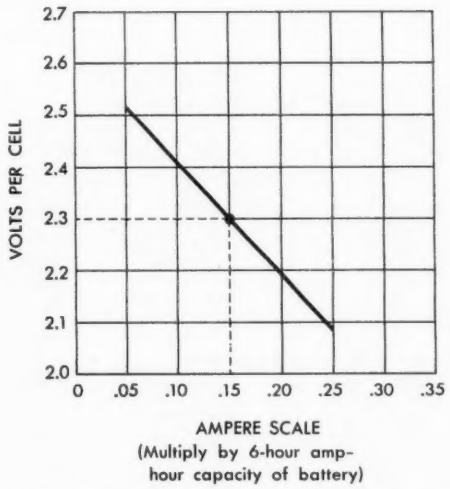
This automatic control system, which is certain to maintain with remarkable consistency the specific gravity of the solution in coal separatory systems, is a development of Wilmot Engineering Co.

Basic principle of the density control system revolves around the use of gamma radiation emitted from radiation isotopes

Better control can mean greater yields, higher production rates, better and more uniform quality product and, consequently, greater profits

Operators' Corner

Chart Provides Easy Method of Determining Proper Rate for Eight-Hour Battery Charges *



TABLE

TOTAL COMPOUND-WOUND GENERATOR VOLTAGE FOR CHARGING AT 2.63 VOLTS PER CELL

NO. OF CELLS	TOTAL GENERATOR VOLTAGE
6	15.8
9	23.7
12	31.6
15	39.5
16	42.1
18	47.4

Fig. 1. Chart for determining eight-hour charge rate for lead-acid motive power batteries (shunt- or compound-wound generator equipment)

A handy chart has been developed which provides a simple method of determining the proper charge rate for any lead-acid motive power battery being charged by motor-generator equipment. For use on electric industrial trucks and mine vehicles, the chart (See figure 1) applies to lead-acid batteries of any number or size of cells, in any state of charge, being charged on an eight-hour basis. It can be used to determine the proper rate with either shunt-wound or compound-wound generator charger equipment.

The chart can help users make sure that their batteries are being charged to full operating capacity. It also can help them avoid damaging batteries by high charging rates.

Following are instructions for using the chart:

1. Place battery on charge for approximately one hour, or until machine is warm.

2. With battery on charge, use voltmeter to determine voltage at battery terminals.

3. Divide terminal voltage by number of cells (see battery nameplate or count the cells).

4. Mark volts per cell on diagonal line of chart.

5. Read down to corresponding point on ampere scale.

6. Multiply this ampere value by six-hour amp-hour capacity of battery (found on battery nameplate). Result is proper rate of charge in amperes at that particular state of charge of the battery.

7a. *With shunt-wound equipment* (generally used for single-circuit chargers), adjust generator field rheostat, usually found under dome of vertical generator or in control cabinet, to produce this proper rate of current.

7b. *With compound-wound equipment* (generally multiple-circuit chargers), adjust heavy series resistor between generator bus and battery to a value that will produce the proper current, first making sure that the generator is set at the total voltage indicated in the table for the number of cells of the battery.

8. Approximately 30 minutes after making adjustment (when current has stabilized), check it by repeating steps 2 through 6 and readjust if necessary.

Example: 16-TG-21 Exide-Ironclad Battery 16 cells, 720 amp-hour six-hour capacity

1. Place battery on charge for approximately one hour, or until machine is warm.

2. With battery on charge, voltmeter reads 36.8 volts at battery terminals.

3. Terminal voltage, 36.8, divided by the number of cells, 16, equals 2.30 volts per cell.

4. Mark point of 2.30 volts per cell on diagonal line of chart.

5. Read down to corresponding point on ampere scale (.15).

6. Proper charge rate: 0.15 times 720 amp-hour (six-hour capacity) equals 108 amp.

7a. *With shunt-wound equipment*, adjust generator field rheostat to charge at 108 amp.

7b. *With compound-wound equipment*, adjust heavy series resistor to produce a current of 108 amp. Set generator voltage at 42.1 (from table), 16 cells multiplied by 2.63 volts per cell.

8. Approximately 30 minutes after making adjustment, check it by repeating steps 2 through 6 and readjust if necessary.

For most accurate charging results, it is recommended that charger adjustments be checked and readjusted, if necessary, near the midpoint of any charge (when cell terminal voltages are between 2.25 and 2.40 volts per cell), not near the beginning or end of the charge.

** Courtesy Exide Industrial Division; The Electric Storage Battery Co.*

A NEW and DIFFERENT

The first machine ever designed for YOUR hauling problems

You can tell just by *looking* at an LW Haulpak® that it's quite unlike any other off-road hauler. Its bowl, for instance, has a distinctive "V" shape; its wheelbase is obviously shorter; it has clean lines, with none of the "hung on" tanks and cleaners so common to other haulers. Yet, these *noticeable* characteristics only *begin* to tell the story. The *fact* is that Haulpak is *completely* different from other off-road haulers!

Behind these differences are two facts: (1) Haulpak is built by a pioneer in heavy-duty *earthmoving* equipment; not by an automotive manufacturer . . . and (2) Haulpak is *designed*, from the ground up, *as an off-road hauler;* it is *not* just a beefed-up highway truck!

Haulpak differences are not "gimmicks", added on for the sake of being different. Everything you see in Haulpak has been carefully engineered with one objective in mind: to give you lower ton-mile costs on your off-road hauling.

Check the exclusive Haulpak advantages described in these pages. Then arrange with your LeTourneau-Westinghouse Distributor to personally inspect and test one of these high-production, low-cost machines. You'll see first-hand how LW Haulpak design can pay off for you.

How LW Haulpak pays off for **Utah Construction & Mining Co.**

Accurate records have been kept on an LW 32 Haulpak working for Utah Construction & Mining Co., Cedar City, Utah. When these records were last tabulated, the unit had been in use 10½ months. These are the performance figures:

JOB REPORT

Scheduled hours of operation		2,681
Hours Haulpak worked		2,211
Hours lost due to Haulpak downtime		250
Hours lost for other reasons than Haulpak being down		220
Operating efficiency $\frac{2,211 + 220}{2,681}$		90.7%
Best month's operating efficiency (except Aug. '58 which was 100%) was in November, 1958		98.0%
Hours of overburden haul	approx.	1,665
Total bank cubic yards overburden hauled		206,164
Total loads hauled		13,744
Bank yards overburden hauled per load	average	15
Average loads per hour (conditions: 2,000 ft. one way, grades from + 8% to −8%)		8.25
Hours of iron ore haul	approx.	546
Total tons, ore hauled		80,266
Total loads of ore hauled		2,112
Tons of ore hauled per load	average	38.0
Average loads hauled per hour (conditions: 10,000 ft. one way, grades from + 5% to −5%)	average	3.87

How does <u>your</u> availability and production compare?

Hauler...built for YOU!

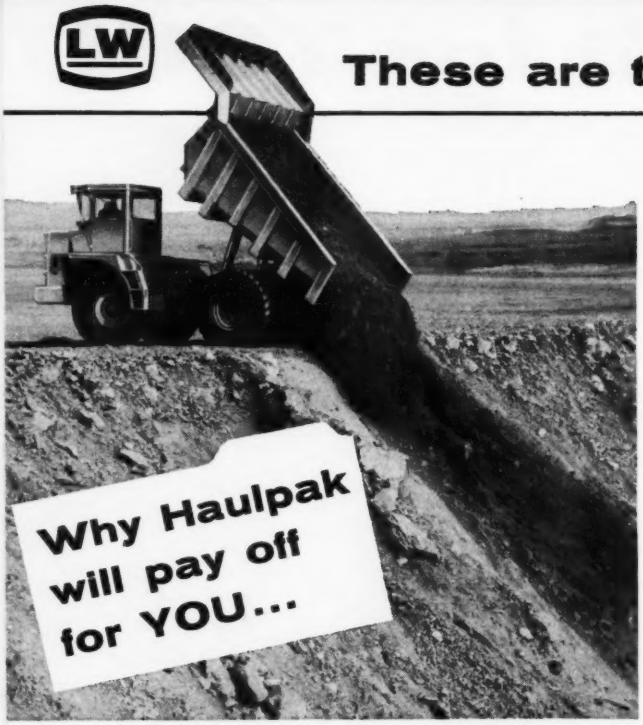
HAULPAK

LW 27.....27 tons

LW 32.....32 tons

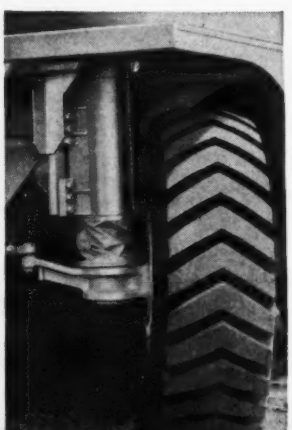
LW

These are the HAULPAK advantages



A highway truck cannot become an off-road hauler just by increasing its "iron", horsepower, or capacity. That's why LW engineers "threw out the book" when designing Haulpak. They started from the ground up to design a *new* concept in off-road haulers. The result is a bigger, tougher, faster, safer machine... with bigger returns on your hauler investment.

1. Biggest radiator in the business. Ample cooling even in 120° operation. (2,000 sq in. of frontal fin cooling, plus oil cooler for torque converter fluid.)
2. "Power-Miser" radiator fan, needs less than 10 hp to move 24,000 CFM of air. (Conventional fans need up to 35 hp!) Automatically disengages when not needed.
3. Cab, and engine hood, are fully mounted on rubber to isolate engine vibrations.
4. 15° windshield tilt reduces glare, keeps dirt and moisture from accumulating.
5. Automobile-sized steering wheel turns Haulpak full left to full right in only 4⅛ revolutions. In either direction, inside wheel can be cut full 45°, for non-stop turning circle only 45' in diameter!
6. 52"-wide cab for greater operator comfort and efficiency. Offset to left for full visibility. Five adjustable ventilators. "Buddy" seat for trainee or time-keeper.
7. Double-reduction rear-end of drive train, proved on LW earthmovers around the world. Only 6 big gears, not 12 little gears as in conventional drives. And over 50% stronger than conventional drive trains!
8. 15% less hp is needed to turn gear train than on conventional trucks. Double-reduction axle also permits bolt-circle wheel mounting, for far less trouble.
9. Final drive sections are interchangeable, right and left. All tires are same size and interchangeable.
10. Differential is famed LW power-transfer unit, unequalled for simplicity, trouble-free operation, and effectiveness.
11. Frame fabricated of special alloy, high-tensile-strength steel. Modified box section construction, continuous welded with integral front bumper, center members, and rear cross section ... for maximum strength.
12. Exhaust-heated body is standard. Keeps body dry for easy discharge of wet, sticky materials. Eliminates exhaust stack, and muffles operation of truck, for greater operator efficiency, safety.
13. Separate emergency power-steering system.
14. Power-assist steering is standard equipment. All steering components are at least 30" above ground.
15. 25" front ground clearance ... 6 to 10 inches more than other haulers.
16. 9'8" width between front wheels, compared to 7' on other trucks.
17. Aircraft-type multiple-disc brakes ... four times bigger than most haulers offer. *Three other brake systems,* including hydraulic retarder.
18. Body is completely rubber-mounted. No wear bars or end plates needed.
19. 4,750 cu in. of high-pressure air storage *in frame,* eliminates need for externally-mounted air storage tank.
20. Twin rams raise body 70° in 16 seconds! Inverted ram mounting avoids dirt falling into ram seals, permits shorter, simpler circuit.
21. Deep-well "V"-shape body carries about 6 tons of material below floor line of conventional vehicles. Gives Haulpak lowest center of gravity, solid stability on turns and side-slope operations.
22. Fuel (105 gallons) is stored in rear frame structure, with convenient center-fill. No need for big, clumsy tank, and not exposed to damage.
23. Straight, smooth body floor speeds ejection. No "kick up" at back, means unit stays steady, and on ground, when dumping.
24. Floor made of super-strength 100,000 PSI yield steel, as is *every* Haulpak surface in contact with the load!

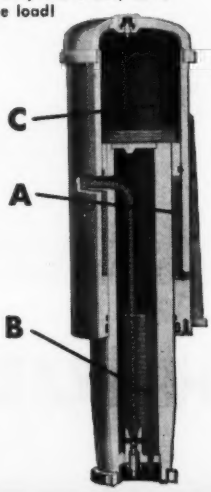


Perhaps the BIGGEST "difference": Revolutionary Hydrair* Suspension

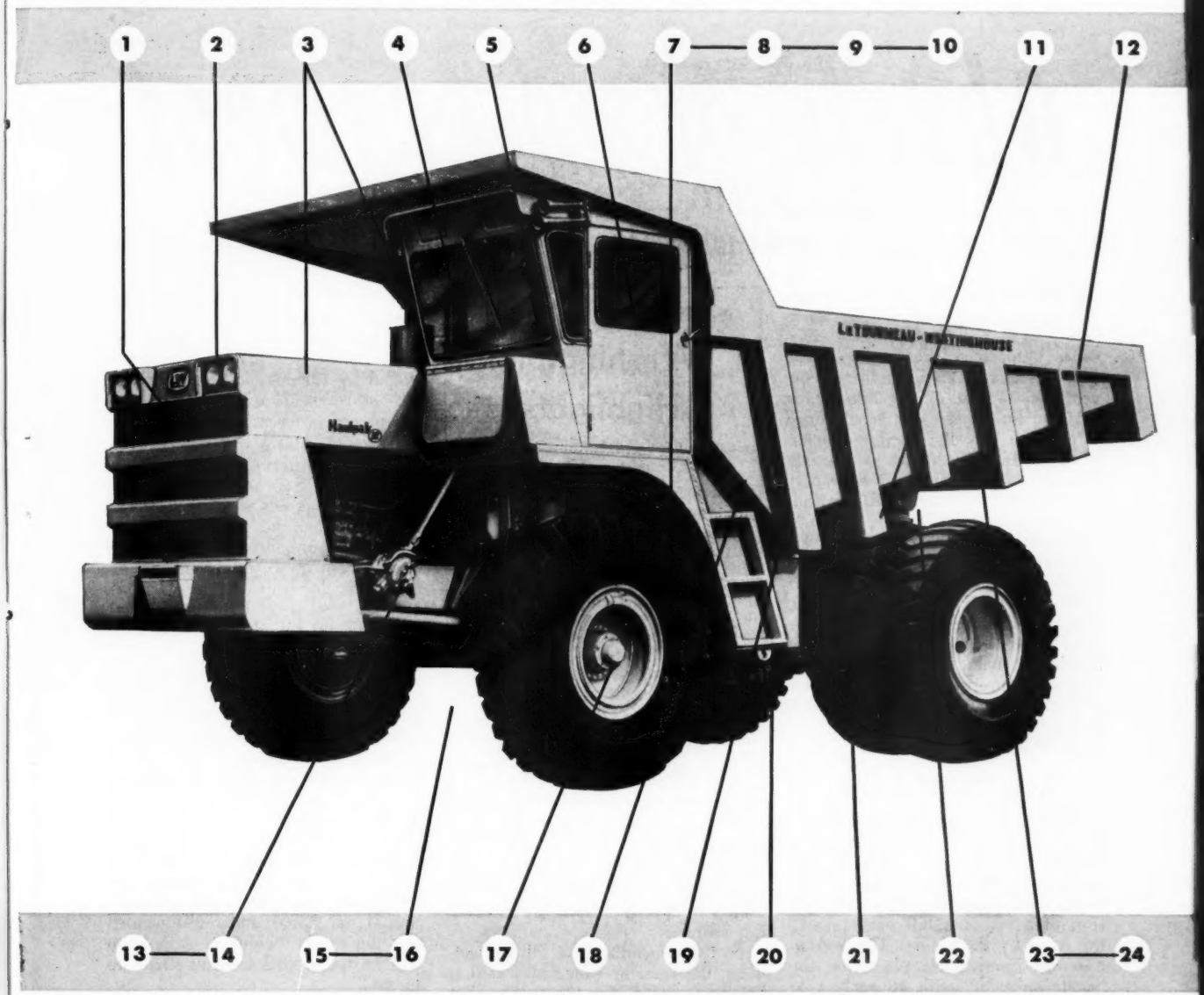
Most unusual feature of Haulpak is Hydrair suspension. Each front wheel is mounted to a piston, which operates inside a frame-mounted cylinder. Surrounding the piston is a circular chamber of oil, (A) connected by tube to an oil reservoir (B) inside the piston. As the wheel rolls along surface irregularities, the up and down motion of the piston forces oil in and out of the piston reservoir. This, in turn, compresses and decompresses nitrogen gas contained in the space (C) above the oil reservoir, snubbing the overall movement of the piston and wheel, thus absorbing shocks and leveling the ride.

In addition to these "spring action" benefits, Hydrair eliminates the need for a front axle and related mountings ... providing substantially higher ground clearance ... and permitting an exceptionally short turn-radius.

*Trademark



that lower your costs . . . boost your output



See "Revolution on Wheels"...new color film on Haulpak...Ask your LW Distributor

As a specialist in earthmoving and off-road hauling, your LW Distributor can help solve your equipment problems. You'll find him and his staff interested in helping you in all phases of your business . . . from production problems, to machine selection, to financing. Put his experience and know-how to work for *you*. Ask for full details on LW Haulpak trucks. See his color film, "Revolution on Wheels".

HP-2255-G-4

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

As Viewed by HENRY I. DWORSHAK of the American Mining Congress

ADJOURNMENT of the Second Session of the 86th Congress is now less than a month away unless some unforeseen crisis arises. The first of the two major political conventions — that of the Democratic party in Los Angeles — is scheduled to convene July 11; the Republicans will meet two weeks later in Chicago. Senators and Representatives play an important part in the deliberations of these quadrennial events, and most observers expect the current session will be ended not later than July 9 in order to permit their attendance.

As usual near the end of a session, Congress is meeting for long hours in order to dispose of major pending legislation including the annual foreign-aid appropriation, medical care and hospitalization aid for the aged, and pay increases for postal and other Federal employees.

COAL RESEARCH BILL ON SENATE CALENDAR

Expanded Government activity in the field of coal research and development moved a step closer to reality May 31 when the Senate Interior Committee approved an amended version of a research bill passed early this year by the House. The legislation was immediately placed on the Senate calendar, with an early vote predicted by its proponents.

Strongly endorsed by the American Mining Congress and other spokesmen for the coal mining industry, the measure would create an Office of Coal Research in the Department of the Interior to conduct a program supplemental to coal research programs now carried on by the Bureau of Mines. This new Office would be empowered to contract for research with interested groups, including coal trade associations, research institutes, educational institutions, and agencies of States and their political subdivisions.

★ ★ ★ ★ ★ ★

Washington Highlights

COAL RESEARCH: Bill clears Senate Committee

MINERALS POLICY: Government agencies air views

FUELS POLICY: Rules Committee fails to give clearance

FOREST ACCESS RIGHTS: Bill is subject of hearings

LEAD-ZINC: Subsidy measure hits roadblock

INDUSTRIAL WASTES: Supreme Court backs Government

CANNELTON CASE: Early decision possible

★ ★ ★ ★ ★ ★

To finance the program, an appropriation of $2 million would be authorized for the fiscal year beginning next July 1; no ceiling would be placed in appropriations for succeeding years.

In recommending the bill's enactment, the Interior Committee said it "observes that within the coal-mining industry only the largest producers have the means to conduct coal utilization research on an effective scale. Since much of the research work carried on by such companies is for the purpose of gaining competitive advantages, the technical knowledge and benefits gained from such research activities ordinarily do not become available to others as they would if conducted by a Government agency."

GOVERNMENT AGENCIES GIVE MINERALS POLICY VIEWS

Legislation to lodge in the Secretary of the Interior responsibility for correlating national mining and mineral policy is imperfect in its present form, according to statements presented by various Government agencies at recent House hearings on a bill passed last year by the Senate.

Royce A. Hardy, Assistant Secretary of the Interior, told the Mines and Mining Subcommittee that his Department agrees with the bill's objectives, which he said "envision a deliberate and concerted effort by the Government to bring about an orderly development of the Nation's mineral resources by fostering an economically sound and efficient domestic mining industry."

He took exception, though, to a provision which would declare it the Government's continuing policy to foster "the orderly development of domestic mineral resources and reserves necessary to assure satisfaction of industrial and security needs." The words "necessary to assure" might imply a degree of dependence upon domestic production that would be prohibitively costly and incompatible with long established national policies, Hardy stated, and recommended that the words "which contribute to the" be substituted for "necessary to assure".

"The manufacturing industries of the United States have historically obtained a portion of their requirements from foreign sources," Hardy said. "Some minerals are not found in the United States in commercial quantities; consequently, industries acquire 100 percent of their needs for these materials from abroad. It is obvious that, for these commodities, self-sufficiency could not be achieved except at excessive and prohibitive cost." Adoption of the proposed amendment, he added, would make it clear that the bill's enactment would not require the Govern-

ment to embark upon a new course "having self-sufficiency beyond prudent and reasonable economic limits as its objective."

Hardy noted that "the benefits to the domestic mining industry that will flow from enactment of the measure will develop only with time."

The Atomic Energy Commission stated it strongly opposes enactment if the measure can be interpreted to vest authority over AEC's raw materials procurement program in the Secretary of the Interior.

Julian Conover, executive vice president of the American Mining Congress, endorsed the measure, stating that AMC policy declarations "have long called for a well defined, long-range national minerals and fuels policy." Clark L. Wilson, chairman of the Emergency Lead-Zinc Committee, said that "the economics of the mining industry certainly justify top-level Administration consideration and action" as contemplated by the bill.

Others submitting statements in support of the legislation included Joseph E. Moody, president of the National Coal Policy Conference; Stephen F. Dunn, president of the National Coal Association; and S. H. Williston, chairman of the American Mining Congress' Strategic Minerals Committee.

The subcommittee has taken no further action.

COMMITTEE TURNS DOWN FUELS POLICY MEASURE

At a hearing late in May, the House Rules Committee heard strong pleas that it clear for floor action revised legislation to authorize the appointment of a joint Congressional committee to study the need for a national fuels policy, but it failed, by a 6-6 vote, to approve the measure. Proponents are now seeking reconsideration.

Rep. Wayne Aspinall (Dem., Colo.), co-sponsor of the resolution, testified during the hearing that the study was not aimed at the regulation of "end use" of competing fuels as has been charged by oil and natural gas producers. "The purpose of the study," he stated, "would be to provide an inventory of our fuel resources. What Congress needs is a framework of information upon which to base any future legislative action in the fuels field, if it is determined that legislation is required."

A special joint committee should make the study, Aspinall said, because no existing committee in the House or Senate has jurisdiction over all of the areas it would be necessary to cover.

Rep. John Saylor (Rep., Pa.), who also sponsored the resolution, said the present fuels policy of the nation "has growed like Topsy." Various Acts have been approved by different standing committees to meet individual problems, he said, and there has been little or no consideration given to the effect of these individual laws on the nation's over-all energy needs.

Saylor suggested that the study cover a broad field, including trade policies. "The State Department should be asked why Canadian natural gas may come into this country duty free while Canada levies a 50-cents-per-ton tax on coal it imports from us," he said.

Rep. Hale Boggs (Dem., La.), who opposed the resolution, said there is no scarcity of coal and the nation has more proved natural gas and oil reserves than ever before. Present conservation laws are adequate to prevent waste, he stated, and the consumer should be free to choose the type of fuel he wants.

SUBCOMMITTEE STUDIES BILL ON FOREST ACCESS RIGHTS

Proposed legislation which would, among other things, deprive owners of mining claims in national forests of their statutory right of ingress and egress over surrounding Government-owned forest lands was stoutly opposed by spokesmen for natural-resource industries at a Senate Forestry Subcommittee hearing late in May.

Requested by the Department of Agriculture, the bill would empower that agency to condition the grant of any right of way over national forest land upon "the granting to the United States of hauling rights or rights of way and easements across the applicants' land to the extent the Secretary [of Agriculture] deems feasible."

Representatives of the lumbering and pulpwood industries, principal targets of the measure, voiced unanimous opposition. George Neff, land manager for The Anaconda Company's Lumber Department, told the Subcommittee that "this seems to me to be an extremely unreasonable price to pay for rights of ingress and egress which the creators of the national forest system guaranteed to owners of intermingled land" in the 1897 Act setting aside forest reserves.

Neff added: "I submit that much of the right-of-way problem of the Forest Service, at least where forest industry property is concerned, is of its own creation, and that reasonable application of common sense to individual problems on a local level would solve most of them in short order."

Shortly before the hearing, Chairman James E. Murray (Dem., Mont.) of the Senate Interior Committee, in a letter to Chairman Allen J. Ellender (Dem., La.) of the Senate Agriculture and Forestry Committee, said: "It would be appreciated if, after action, if any, is taken by your Committee, you would recommend that the bill then be referred to the Interior and Insular Affairs Committee so that this Committee may also study the bill in respect to those matters which are clearly within its jurisdiction."

LEAD-ZINC SUBSIDY BILL HITS COMMITTEE SNAG

Although Chairman Aspinall (Dem., Colo.) of the House Interior Committee had requested the House Rules Committee to give the "green light" for a House vote on legislation to authorize payment of Government subsidies to small domestic producers of lead and zinc ores and concentrates, the Rules group declined to approve the measure at a meeting early this month. This dims the outlook for its enactment prior to adjournment of Congress.

According to the Interior Committee, purpose of the measure is "to stabilize the mining of lead and zinc by small producers, to help conserve domestic reserves of lead and zinc, and indirectly to provide jobs for unemployed miners."

Government payments to eligible producers would amount to the difference between what they receive at current market prices and what they would have received had market prices been 17 cents and 14½ cents per pound for lead and zinc, respectively. An annual appropriation of $4.8 million would be authorized to cover the cost of the program, which would expire June 30, 1965.

In general, small producers would be defined by the bill as those who produce ores or concentrates with a recoverable content of not more than 2,000 tons of lead and/or 2,000 tons of zinc annually.

COURT UPHOLDS GOVERNMENT IN INDUSTRIAL WASTES CASE

Mining companies located near navigable waterways have evinced interest in a recent decision of the U. S. Supreme Court upholding the Federal Government's power to prohibit the discharge into navigable rivers of industrial wastes that result

Breaking rock by the ancient method of fire-setting as practiced in the 16th Century (from *De Re Metallica*)

1960 Mining Show

Biggest mining event of the year to be held in Las Vegas, Nevada, October 10–13

TIME was when progress in advancing the art of mining was slow. For example, Agricola's *De Re Metallica* was the standard mining reference for almost 200 years prior to 1740.

Yes, progress was exceedingly slow in the mining industry in those early days. It has only been for the last 30 years or so that the industry has concentrated on making full use of a rapidly advancing technology — now moving ahead so fast that it is difficult to keep abreast of all the developments in mining techniques and equipment. The conventions of the American Mining Congress are intended to meet this situation by keeping the industry's key personnel fully up to date on policy matters and technological progress.

That is why every mining man should now make plans to attend the 1960 Mining Show. It promises an unparalleled opportunity to hear authoritative talks on subjects of vital concern, and to see the latest equipment available to the industry.

Always an outstanding event, this year's exposition is expected to surpass all previous displays. Mining people will have plenty of time to examine the latest devices and equipment for modernizing the industry's mines and plants. Manufacturers' representatives will be on hand and eager to help solve the toughest problems in attaining efficient, safe and economical operations.

As for the sessions, a meeting of the State Chairmen of the *Program Committee* will be held in Las Vegas this month to develop the most comprehensive and interesting program possible. From hundreds of suggestions, the committee will select those speakers who can best answer the questions uppermost in the minds of the men who produce the Nation's minerals.

Since attendance is expected to reach record proportions, those planning to attend are urged to make reservations for accommodations without further delay by writing to the AMC Housing Bureau, Convention Center, Paradise Road, Las Vegas, Nevada.

in reduction of navigable capacity.

Involved in this case were three steel plants adjacent to the Calumet River near Chicago. The Army Corps of Engineers, which is required to maintain a 21-foot channel in the river, asserted that the companies were causing a menace to navigation in that fine particles of various solid materials discharged into the river through sewers had a tendency to flocculate and settle to the bottom and had, in some places, reduced the depth of the channel to 12 feet.

A Federal district court, after a lengthy trial, enjoined the companies from depositing industrial solids in the Calumet River without first obtaining a permit from the Army Chief of Engineers providing conditions for the removal of deposits, and it ordered each of the companies to restore the depth of the channel to 21 feet by removing designated percentages of existing deposits. The Court of Appeals reversed the lower court with directions to dismiss the Government's complaint on the ground that the defendents' actions were not prohibited by law and, in any event, injunctive relief could not be granted.

The Supreme Court overruled the appellate court by a 5-to-4 vote. Justice Douglas, for the majority, said that the Rivers and Harbors Act of 1899 provides that "it shall not be lawful to excavate or fill, or in any manner to alter or modify the . . . capacity of . . . the channel of any navigable water of the United States, unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of the Army prior to beginning the same." He added: "Our conclusions are that the industrial deposits placed by respondents in the Calumet have, on the findings of the District Court, created an 'obstruction' within the meaning of Section 10 of the Act." The majority also concluded that the District Court was authorized to grant injunctive relief.

In the dissenting opinion, Justice Harlan said that "in order to reach what it considers a just result, the Court [majority], in the name of 'charitably' construing the Act, has felt justified in reading into the statute things that actually are not there." He continued: "The filling of deficiencies in the statute, so that the burdens of maintaining the integrity of our great navigable rivers and harbors may be fairly allocated between those using them and the Government, is a matter for Congress, not for this Court."

EARLY DECISION POSSIBLE IN CANNELTON CASE

Before the month is over the Supreme Court may issue its decision in *U. S.* v. *Cannelton Sewer Pipe Co.*, involving the "cut-off point" for computing percentage depletion in the case of a clay sewer pipe producer. The decision may have an important bearing on the percentage depletion deductions of mineral producers generally.

personals

H. S. Harrison, executive vice president of the Cleveland-Cliffs Iron Co. since 1958, recently was elected president of the company. Harrison, after joining Cleveland-Cliffs in 1932, was made assistant treasurer in 1940. He became treasurer five years later and in 1952 was named a vice president. In addition to being a director of Cleveland-Cliffs, Harrison is on the board of directors of Jones & Laughlin Steel Corp. and Medusa Portland Cement Co.

Graham J. Morgan, executive vice president, United States Gypsum Co. has been elected president to succeed **O. M. Knode,** who is retiring. Knode came out of retirement in 1949 to reassume the presidency; he has been associated with the company since it was founded in 1902. He had previously been president from 1936 until 1942. Morgan joined the company in 1939 as a salesman.

C. William Davis has been elected president of the Southern Coal Producers' Association. He succeeds **Joseph E. Moody,** president of the National Coal Policy Conference, who will continue to be associated with Southern Coal Producers' Association in a consulting capacity. Davis has been executive secretary of the Bituminous Coal Operators' Association since 1958.

Tell Ertl, oil shale consultant and head of the U. S. Bureau of Mines research team at the Bureau's Rifle, Colo., oil shale unit from 1944 to 1948 has joined Cameron & Jones, Inc., as its chief mining engineer. Cameron & Jones is an engineering firm specializing in the fields of oil shale and fuels technology.

John R. Foster, superintendent of Orient No. 2 mine, Freeman Coal Mining Corp. recently retired and has been succeeded by **Arlie Cook,** former mine manager. Foster was superintendent at Orient No. 2 in 1928 when it hoisted 15,175 tons in an eight-hour shift to set a world record that still stands.

W. L. Tillotson has been named general manager of the Idaho Phosphate Works of Central Farmers Fertilizer Co. He succeeds **A. L. Stutts,** who recently resigned.

John J. Greer has been named foreman of stripping at No. 34 mine, U. S. Steel Corp., at Lynch, Ky.

J. S. Chapman, assistant to manager, coal mines, Armco Steel Corp., has been promoted to assistant chief safety engineer on a company-wide basis. Chapman, who joined Armco in 1937 as a tipple foreman, had been assistant to manager, coal mines, since 1948. In addition to being affiliated with the West Virginia Coal Mining Institute, he is a member of the American Mining Congress Committee on Mine Safety.

J. A. Hunt was recently elected chairman of the board, and **W. A. Haslam,** president of New River Co. Haslam succeeds **C. R. Bourland** who has retired. Haslam, who will retain his position as president of Winding Gulf Coals, worked for Island Creek Coal Co. until 1950 as manager of mines when he joined New River as assistant to the vice president in charge of operations. He became vice president in charge of operations during 1954. In late 1955 he joined Winding Gulf Collieries as executive vice president, moving up to the presidency in mid-1956.

Clarence W. Six, who served Cyprus Mines Corp. as tax accountant and assistant treasurer for 23 years, has retired. Prior to his association with Cyprus, he served the Lucky Tiger-Combination Gold Mining Co. in a similar capacity for 17 years. Six expects to remain active by doing private work in mining income taxation.

Virgil A. Curry was recently appointed to succeed Alex Grant as manager of the Youngstown Sheet & Tube Co. coal mines in Pennsylvania and West Virginia. Curry will be in charge of operations of Buckeye Coal Co., Nemacolin, Pa., Youngstown Mines Corp., Dehue, W. Va., and Olga Coal Co., Coalwood and Caretta, W. Va. He has been superintendent of the Dehue mine since 1941, having joined Youngstown in 1927 as chief electrician.

V. A. Curry

Succeeding Curry as superintendent at Dehue is **M. M. Fitzwater, Jr.,** production foreman at Olga.

J. D. Crawford has succeeded **Charles Johnston** as president of the Alaska Miners Association. Crawford is vice president and general manager of Alaskan Operations, United States Smelting Refining & Mining Co. and Johnston is treasurer, Goodnews Bay Mining Co., Inc.

Morris V. Mielke has been appointed assistant to vice president-operations, Oliver Iron Mining Division, U. S. Steel Corp. At the time of his appointment, he was assistant general superintendent at the division's Eastern District operations at Virginia, Minn. Mielke joined Oliver in 1948 as assistant concentration engineer in its Duluth Research Laboratory where he worked on problems of ore analysis in connection with the practical utilization of Minnesota's low grade ore and taconite reserves.

H. S. Anderson, manager, mining department, New York & Honduras Rosario Mining Co., has been named a vice president of the company.

George W. Streepey, general manager of the raw materials division, Aluminum Company of America has been promoted to assistant production manager of the raw materials and refining divisions. **Roy F. Miller,** chief mining engineer for Alcoa, succeeds Streepey as general manager of raw materials.

G. Albert Shoemaker has been elected president of Consolidation Coal Co. Formerly executive vice president, he fills the position left vacant by the recent death of A. R. Matthews.

R. Shoemaker

D. McElroy

Shoemaker was associated for several years with Babcock & Wilcox Co. in an engineering capacity until joining Union Collieries Co. in 1930. He became vice president of one of Consol's predecessor companies in 1945 and the following year was elected president of Pittsburgh Coal Co. division of Consol. Later he became president of that division and was subsequently elected executive vice president of Consol in 1952, and a director in 1956. In addition to his executive position with Consol, Shoemaker is president and a director of Mathies Coal Co. (an associate company); and a director of Dravo Corp., Harmar Coal Co., National Potash Co., Pitt-Consol Chemical Co., and North-Western Hanna Fuel Co. He is also president and a director of the Western Pennsylvania Coal Operators Association.

Dennis L. McElroy has succeeded Shoemaker as executive vice president. McElroy has been a vice president of the company since 1947, first as vice president in charge of engineering, and in recent years as vice president in charge of operations. He is a former professor of mining engineering at West Virginia University, where he also served as director of the School of Mines. From 1941 to 1943, he was chief of the Coal Section, War Production Board. He became chief engineer of Consolidation Coal Co. (W. Va.) in 1943, and was subsequently named vice president of Pittsburgh Consolidation Coal Co., later renamed Consolidation Coal Co.

James P. Giles, Jr., has been elected executive vice president of the American Cement Corp. Giles also is president of the Hercules Cement Co., division of American Cement. He joined Hercules as assistant to the president in 1951.

Allen L. Chickering, Jr., has been elected chairman, succeeding **Garner A. Beckett,** who has been elected honorary chairman. Chickering, a member of a San Francisco law firm, was a director of Riverside Cement Co. before its merger with American Cement.

Andrew R. Sims has retired as general superintendent of Anaconda Co. mines in Butte, and has been succeeded by **Edward O. Bonner,** an assistant general superintendent.

Sims who first worked in the Butte mines during 1915, became an assistant foreman in 1925 and later a foreman of the West Colusa, Stewart and Tramway mines. In 1946 he was named planning engineer for the Kelley mine. He was promoted to assistant general superintendent of mines in 1950, and to general superintendent of mines in 1952.

E. O. Bonner

A. R. Sims

Bonner joined Anaconda in Butte in 1936 and has worked as a miner, sampler, safety engineer, research engineer, shift boss, assistant foreman and mine foreman. He was appointed assistant general superintendent of mines in 1952, and prior to his recent promotion was in charge of the Berkeley and Alice pits, Badger and High Ore mines and the Black Rock-Elm Orlu low grade zinc project.

Walter Hochschild has been elected chairman of the board and chief executive officer of American Metal Climax, Inc., to succeed **Arthur H. Bunker,** who is retiring. Bunker was elected an honorary chairman of the board and chairman of the executive committee. At the same time, **Frank Coolbaugh** was named president of the company.

Hochschild joined The American Metal Co., Ltd., in 1920, became a director in 1928, its president in 1950, and since the merger with Climax Molybdenum Co. in 1957 has been vice chairman of the company. From 1947 until the merger, he also was a director of Climax. He is chairman of the board of directors of Tsumeb Corp., a director of the companies in the Rhodesian Selection Trust Group, and of O'okiep Copper Co.

Coolbaugh, a graduate mining engineer, joined Climax Molybdenum Co. at Climax, Colo., in 1933. Beginning in 1948 he served successively as assistant general superintendent, resident manager, and later general manager of all mining operations. In 1954 he was elected vice president of Western Operations of Climax, and in 1959 became president of the Climax Division of the merged company. He was elected a director of Climax in 1955 and of the combined company upon the merger.

Bernard W. Bernstrom, formerly chief mechanical engineer for Pickands Mather & Co., has joined Jones & Laughlin Steel Corp. as raw materials engineer in the company's engineering department. He will be responsible for the coordination of engineering policies, procedures and standards related to J & L's mining activities.

Jack F. B. Silman of Toronto, Canada, has joined the Mining & Exploration Department of International Minerals & Chemical Corp. as an exploration geologist. Silman has had nine years of varied experience in mineral exploration programs throughout Canada, including extensive uranium exploration in the Beaverlodge and Blind River areas.

Marlin E. Sandlin has been elected chairman of the board of Pan American Sulphur Co. He replaces **J. R. Parten** who is retiring.

Lake Superior Mines Safety Council recently elected officers for the 1960–1961 year, including: president, **L. J. Hall,** supervisor of safety, Reserve Mining Co.; vice president, **Walter O. Gunelson,** safety supervisor, M. A. Hanna Co.; secretary, **Allen D. Look,** district health and safety supervisor, District F, U. S. Bureau of Mines and, treasurer, **A. J. Windl** (retired), Olgebay Norton Co.

James R. Garvey has become director of the National Coal Association's newly-created Research Department. Garvey was also recently named vice president and director of research for NCA's affiliated organization, Bituminous Coal Research, Inc., with which he has been associated since 1946. Prior to joining the staff of BCR, he had been employed by Hanna Coal Co. and Pittsburgh Coal Co.

Robert G. Peets has been appointed assistant resident manager of Meramec Mining Co., according to a joint announcement by St. Joseph Lead Co. and Bethlehem Steel Corp., owners of Meramec. Peets, who will take over his new duties July 1, joined Bethlehem in 1938 as a trainee in the company's Loop Course for college graduates. His first assignment in the company's mining division was at the Cornwall, Pa., mine. In 1947 he was appointed chief mining engineer and in 1955 was named general superintendent of the Cornwall Division. Peets has also served as consulting engineer to Cia. Minera Autlan, Jalisco, Mexico, a manganese operation in which Bethlehem holds an interest.

Ernest L. Ohle, chief geologist since 1957 of the Copper Range Co. and its subsidiary, White Pine Copper Co., has been named vice president-exploration of Copper Range.

R. E. Snoberger, retired president of Truax-Traer Coal Co., has announced his resignation as a member of the company's board of directors. Snoberger, well known and long active in the coal industry, served as president of Binkley Coal Co. prior to its merger with Truax-Traer in 1950. Subsequent to the merger, he served as executive vice president and was elected president of Truax-Traer in 1952, a position he held until his retirement because of poor health in 1955.

David R. Mitchell, widely known consultant in coal mining and coal preparation, has been named associate dean of the College of Mineral Industries at Pennsylvania State University, effective June 30. He will continue also as professor of mining engineering and as chairman of the Division of Mineral Engineering.

Professor Mitchell, who holds an Engineer of Mines degree began his career in teaching as an instructor at the University of Illinois in 1927. He later became associate professor of mining and metallurgical engineering. He joined the faculty at Penn State in 1938 and since 1944 has been chairman of the Division of Mineral Engineering.

Robert J. Linney was recently elected president and a director of Reserve Mining Co. He was formerly executive vice president of Reserve, which is jointly owned by Republic Steel Corp. and Armco Steel Corp.

R. Linney

Linney was employed by the Chateaugay Ore and Iron Co. at Lyon Mt., N. Y., in various capacities between 1929 and 1939. He became general manager of that mining and blast furnace operation in 1937. After Republic Steel acquired those properties and the mines at Port Henry in 1939, Linney was named general superintendent of the Port Henry District and became district manager in 1945. In 1950 he was selected to become Reserve's manager of operations. He was named vice president in charge of operations in 1956 and was elected executive vice president two years later. In addition to his duties as president, Linney will serve as a member of the executive committee.

At the same time, the company announced election of **E. R. Johnson** as a member of the board of directors. He is assistant president and first vice president of Republic Steel. He succeeds **W. M. Kelley,** formerly president of Reserve, as a director of Reserve.

Harry D. Feltenstein Jr., has been named president and chief executive officer of Lithium Corporation of America, replacing **Herbert W. Rogers,** who moves to the newly-created post of chairman. Feltenstein previously had been executive vice president.

OBITUARIES

George Bates Harrington, dean of the midwestern coal industry, died May 12 in Chicago.

Born in 1881, Mr. Harrington was a graduate of Princeton University and Massachusetts Institute of Technology. He went to Mexico as a mining engineer in 1904, later following his chosen profession in the west, with Stone & Webster Corp. In 1914 he was made president of the newly organized Chicago, Wilmington & Franklin Coal Co., and for the next 40 years directed the operations of the large Illinois coal company. He retired in 1955 when CW&F was sold to the Freeman Coal Mining Corp.

One of the events of which Mr. Harrington was proud was the setting of a world record in 1928 at the Orient No. 2 mine, when 15,174 tons of coal were hoisted in one eight-hr. shift. Late in his career, he directed the development of the Orient No. 3 mine with a capacity of 14,000 tpd at Waltonville, Ill.

Mr. Harrington was a director of the Materials Service Division of General Dynamics Corp. and for many years was a director and member of the executive committee of the American Mining Congress. In 1944 he was awarded the William Lawrence Saunders medal for distinguished service in mining by AIME.

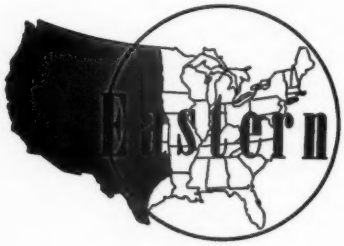
Arthur Roeder, 75, retired president and chairman of the board of Colorado Fuel & Iron Corp. died in Madison, N. J., May 10.

Mr. Roeder had been named receiver for Colorado Fuel & Iron Co. in 1933 and became trustee of the company the following year. He was named president of the reorganized Colorado Fuel & Iron Corp. in 1936 and was chairman of the board from 1938 until he retired in 1945.

Quincy Adams Shaw, 91, former president of North American Mines, Inc., and president of Calumet & Hecla Consolidated Copper Co. from 1910 to 1941, died in Boston, Mass., May 8.

Blair Livingston Sackett, 73, former general plant superintendent and metallurgical manager at the Tooele, Utah, plant of International Smelting and Refining Co., died April 27 in Salt Lake City. Mr. Sackett retired in 1956 after 44 years with the Anaconda subsidiary.

NEWS and views



Cerro de Pasco to Change Name

At Cerro de Pasco Corporation's annual shareholders' meeting, stockholders voted overwhelmingly to approve a resolution to change the name of the corporation to "Cerro Corp." It was announced the name change would be made effective on or about January 1, 1961.

It was also revealed at the meeting that Cerro plans to make capital expenditures of $21,000,000 in 1960. This amount will be the largest ever expended by the organization in a single year. Of this, $11,000,000 is for replacements and additions to copper and aluminum fabricating plants in the United States. The remaining $10,000,000 is for replacements and additions to Cerro's mines, smelters and refineries in Peru, for an oil prospecting venture in eastern Peru, and for preliminary development work on the Rio Blanco copper mining property in Chile.

Also revealed were Cerro's plans for increasing lead and zinc ore production at its principal operating mine in Peru—the Cerro de Pasco. It is gradually to be converted into an open-pit operation. For the past half century, the mine has been operated as an underground mine.

Utility to Test Coal Gas Turbine

A generating cycle combining a steam turbine and a gas turbine is to be installed in the Muskingum River plant of the Ohio Power Co. at Beverly, Ohio. The gas turbine will be built adjacent to, and will operate in combined cycle with, one of the plant's present 215,000-kw steam turbines. It is expected that the gas turbine will be completed and in operation by spring of 1961.

The objective of the combination cycle is added efficiency of generation. The new gas turbine unit not only will generate an additional block of 5000 kw of electric power on its own, but it will also supply combustible by-products to the steam boiler. This will reduce the amount of coal required by the boiler to feed the 215,000-kw steam turbine.

Previously, the use of gas turbine in power production has been limited and they have burned only natural gas, and distillate and bunker C oils. The Muskingum River installation will be the first time that coal gas will be used.

The United Electric Coal Companies has announced the completion of its new Banner mine, which is on the Illinois River, a few miles southwest of Peoria, Ill.

The 4000 tpd operation uses a 45-yd shovel in the pit for stripping operations. Coal is delivered from the pit to a truck dump moved by conveyor to a crusher and then on to a 2500-ton storage pile. Coarse coal is washed in a dense media system and can be crushed and rescreened to special domestic, commercial and industrial stoker sizes. Fine coal is air cleaned. Prepared coal is conveyed from the preparation plant to three storage bins, two of 1500-ton capacity, and one of 1000-ton capacity, which provides surge capacity between preparation plant and the barge loading conveyor.

Tri-State Zinc to Develop American Zinc Property

American Zinc, Lead & Smelting Co. and Tri-State Zinc, Inc., have approved, in principle, an agreement whereby American will make available to Tri-State a tract of mineral lands located near New Market, Tenn., for developing and mining zinc ore.

American has diamond drilled a reserve estimated at approximately 1,000,000 tons of high-grade zinc concentrates on this property. Tri-State has agreed to complete development by diamond drilling to prove the indicated reserve and thereafter to start the necessary sinking of shafts or incline to bring the mine into production at the earliest possible date.

While the mine development is in progress, a modern concentrating plant with a daily capacity of 3600 tons will be constructed and equipped by Tri-State.

American will supply to the new milling facility from its own mines a major part of the tonnage milled until Tri-State has completed its mine development to a point that will utilize the new milling capacity.

All concentrates produced from this property will be made available to American for use at its plants located in Illinois, Arkansas, or Ohio.

It is estimated that the total capital investment by Tri-State will be be-

tween $3,000,000 and $4,000,000 and that the annual production when mine development is completed will be between 35,000 and 40,000 tons of zinc concentrates.

Tri-State Zinc, Inc., is a wholly-owned subsidiary of Gold Fields American Development Co. Ltd., which in turn, is a wholly-owned subsidiary of the Consolidated Gold Fields of South Africa Ltd. of London, England.

Effective Process for Reducing Sulfur in Coal Now Possible

Significant results leading toward the probable reduction of sulfur in bituminous coals have been achieved by Bituminous Coal Research, Inc., during fundamental research under cosponsorship of the electric utility and coal industries. The two-project program, whose objective is the reduction of atmospheric contaminants in flue gases, is sponsored by the Association of Edison Illuminating Companies and Edison Electric Institute, jointly representing investor-owned electric utility companies, and Bituminous Coal Research, Inc., representing the coal industry.

Working with five high-sulfur bituminous coals from different areas of the United States, BCR has been able to liberate a substantial amount of the pyritic sulfur from the coal material. As a result, the Joint Research Advisory Committee and BCR, in whose laboratories the work is being done, have concluded that an effective process for reducing sulfur in bituminous coals is now possible. Further work must be carried out to develop the economics of various processes to achieve this end.

The growing national interest in air pollution motivated joint support of the two-project program by the electric utilities and the coal industry. One project consists of engineering evaluation and exploratory research on methods for control of atmospheric contaminants in flue gases after the coal is burned; the other project attacks the problem by removing pyritic sulfur from coal before the coal is burned in the power plant. The forward scientific step was made on the latter project.

Pitt Steel Strengthens Iron Ore Supplies

A new program will result in 70 percent of Pittsburgh Steel Company's ore requirements being supplied by mines in which the company has ownership interest. At present the company obtains only 40 percent of its ore from mines in which it is owner or part-owner, and has to contract with other firms for the rest, or buy in the open market at "higher cost."

In what it termed the most important part of the program, Pittsburgh Steel joined U. S. and Canadian companies in Wabush Iron Co., Ltd. This property is designed to start delivering iron ore concentrates to Pittsburgh Steel in approximately five years. Wabush has already begun development of a five-sq mile ore deposit in Wabush Lake, 200 miles north of Seven Islands in Newfoundland and near the western border of Labrador.

Other owners of Wabush are Youngstown Sheet & Tube Co., Inland Steel Co., Steel Co. of Canada, Interlake Iron Corp. and Pickands Mather & Co., operator of the property.

Rhodesian Copper's Future Prospects

Sir Ronald L. Prain, chairman of Rhodesian Selection Trust Ltd. and Roan Antelope Copper Mines Ltd., recently reported on the companies' affairs at an informal stockholders meeting in New York. This unique meeting is perhaps the only instance of its kind in which the head of a major mining enterprise with headquarters in another country meets with the companies' American stockholders for a thorough review of company affairs.

On the following day Sir Ronald addressed the New York Society of Security Analysts, pointing out that "the copper mines of Central Africa are an indispensable part of the structure of modern civilization and will be required to play an increasingly important part in the world's industrial developments for the foreseeable future." His talk was concerned with the Rhodesian Selection Trust Group of Companies and its place in the world copper industry.

The main activities of the R. S. T. Group are the production and sale of copper from mines in Northern Rhodesia, and the exploration for copper and other minerals throughout the Federation of Rhodesia and Nyasaland and, in some circumstances, beyond its borders. After briefly describing the Copperbelt where all of the concern's existing mines, smelters and refineries are located, Sir Ronald delved into the Group's corporate set-up and told how the organization produced and transported its copper. He also touched on expansion projects which will increase annual production by about 60,000 tons in the next two or three years. Its present rate of production is approximately 235,000 tons of copper per annum.

Of particular interest was his keen analysis of future prospects for Rhodesian Selection Trust and related companies and their business in Central Africa. Sir Ronald said that three factors "will inevitably play a part in determining the future prosperity of the companies of our Group and, indeed, of the Northern Rhodesian copper mining industry as a whole. The first is the satisfactory evolution of the political future of the territories in which we operate; the second is the behavior of the copper market in years to come; and the third is the ability of our mines to keep costs at a viable level."

He regarded the first of these factors as by far the most important and said: "Our companies take no part whatsoever in politics; but we have

special responsibilities arising from the fact that we operate in a multi-racial society and our employes include both European and African workers. We thus have a major interest in ensuring that goodwill is established and fostered, not only in the immediate sphere of our operations, but also in the wider field surrounding and affecting those operations.

"In our own sphere of mining," Sir Ronald said, "Africans have since 1955 been given the opportunity to move into 'advanced jobs,' most of which had hitherto been exclusively reserved for Europeans. Much remains to be done in opening up further advancement opportunities and in educating and training Africans to enable them to take advantage of such opportunities."

Elaborating on future prospects, Sir Ronald said that the R. S. T. Group has under its control total reserves of about 430,000,000 tons, running at 3.06 percent copper, or about 11 percent of the estimated Free World copper reserves. At present it is hoisting about 10,000,000 tons of ore per year and producing 225,000 tons of copper; this will soon increase to nearly 300,000 tons. "Our ore reserves," he stated, "which were 260,000,000 tons 25 years ago, have in fact been increased by 66 percent despite the removal of some 180,000,000 tons since mining operations began. Moreover, the major prospecting and exploration programs which we are conducting in Northern Rhodesia and in other parts of Central Africa will, we hope, one day result in the discovery of new viable orebodies."

Explaining that it was not possible to place any time or volume estimate on expansion of the industry beyond figures given, he said that "much will depend on the future pattern of the world copper industry, of which the Northern Rhodesian industry is an integral part." He expressed the view that copper has long term prospects "which few other commodities can equal in promise and I believe that we in Rhodesia are well equipped to hold and increase our place in this expanding industry."

Inco to Start New Open Pit Operation

A new mining operation, the Clarabelle open pit, will be started by The International Nickel Company of Canada, Ltd., on an outcropping orebody in the Clarabelle and Lady Lakes area to the southwest of the company's Murray mine in the Sudbury District of Ontario. Part of the long-range program to maintain the continuity of Inco's operations in the Sudbury District, the Clarabelle pit is scheduled to go into production in the latter part of 1961. Ore will be shipped to Inco's Copper Cliff mill by rail.

X-RAY ANALYTICAL METHODS IN PROCESS CONTROL

(*Continued from page 86*)

time requirement was only 2.5 minutes per sample. By this technique, one could assay with suitable equipment a number of samples with a single x-ray head but the larger the number of samples the greater the delay for any given circuit. Obviously the dollar worth of the assays would determine whether continuous or discontinuous monitoring should be practiced.

Tests Simulated Plant Operations

During all test periods, staff members were present to observe the operation of the equipment, to determine pulp densities, and generally to record data and observations. As a matter of precaution, the reproducibility of assays of the x-ray was quickly and adequatedly checked by replacing the pulp sample cell with a briquette of similar material previously assayed by chemical methods. During continuous test runs of several days length such checking was made routinely (and recorded by pen tracing), but x-ray adjustments were limited to day shift only (barring break-downs, of course). In this way, the test simulated anticipated plant operation wherein routine maintenance would be on a single shift only.

Table 3. Quantrol Operating Conditions

X-Ray Tube	
Target material	High purity platinum
Target excitation for bulk and scavenger tailings and ore	40 KV @ 30 MA
Target excitation for final concentrates	20 KV @ 10 MA
Analyze Channel	Cu K-Alpha (2nd order) @ 1.542 A°
Monitor Channel	P L-Beta (2nd order) @ 1.100 A°
Primary Slit Width	0.010 in. both channels
Secondary Slit Width	0.020 in. both channels
Diffraction Crystal	Li F @ 4 in. radius, both channels
Detectors	Geiger type, paired
Channel voltage, analyze	1290
Channel voltage, monitor	1308
Sensitivity	433
Zero Depress	167
Time Constant	30 or 60 seconds to average random "noise"
Ratio Amplifier	10 (analyze signal must exceed monitor signal)
Recorder	L&N Speedomax G (modified 0-50 MV)

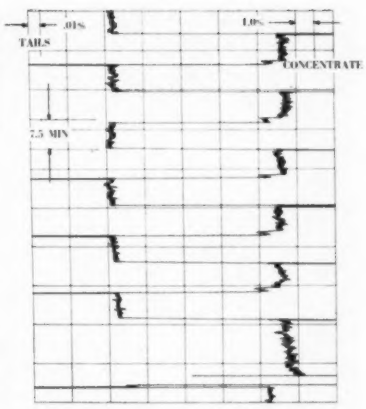


Fig. 9. Tracing illustrates that flushing the sample cell for one minute was sufficient to prevent contamination of bulk tailings even by final concentrates

In conclusion a number of points deserve mention:

1. The x-ray technique was successfully applied to the continuous monitoring of typical mill pulps extending from the copper concentration levels of final concentrates at 22 to 32 percent, to bulk tailings at 0.10 to 0.25 percent.

2. The quality of the copper assays approximated those of conventional assays.

3. The assays, furthermore, were available either continuously or instantaneously at discontinuous intervals, upon choice.

4. Armed with this live assay information, mill operators maintained a closer metallurgical control of the individual flotation sections being tested at the time and could be expected to do as well, or better, when all circuits were so monitored. If so, increased grades of concentrates at slightly improved recoveries are predicted.

5. The manufacturer's equipment used in the test demonstrated sufficient sensitivity and reliability to warrant expectation of long term continuous operation with a considerable reduction in direct labor and supply costs when compared with conventional chemical assay methods.

"BOY, I SURE FEEL RUN DOWN TODAY."

Mesabi, Reserve Reach Agreement

Mesabi Iron Co. stockholders have approved a royalty agreement with Reserve Mining Co. that replaces an earlier pact under which Reserve paid Mesabi on the basis of one-third of the net profits.

The new agreement with Reserve Mining provides the payment of $1.00 a ton royalty on all iron products up to 6,000,000 tons annually produced and shipped after January 1, 1960, based on a content of 61 percent natural iron, with appropriate adjustments for variations in the iron content. Royalty also will be adjusted on the basis of the Bureau of Labor Statistics Wholesale Commodity Price Index, as of November 1959.

The settlement also provides some reduction in the royalty for the next 3,000,000 tons produced over 6,000,000 tons a year for 25 years. There would be another modest cut in the royalty for all the tonnage over 9,000,000 tons a year.

Reserve also is paying Mesabi $400,000 in cash and is assigning to the company all of the 163,570 shares of capital stock of Mesabi that Reserve owns.

The agreement ends four years of litigation and arbitration between the two concerns over the interpretation of the earlier profit paying agreement. Reserve is one-half owned by Republic Steel Corp. and one-half by Armco Steel Corp., and mines taconite iron ore lands in Minnesota under a lease from Mesabi.

Oliver to Streamline Operating Organization

Consolidation of Oliver Iron Mining Division's two operating districts in Minnesota into one operating area became effective May 1. The new move was designed to strengthen Oliver's competitive position through improved blending of ores, quality control and production efficiency.

Under this arrangement Oliver's activities on the Minnesota Ranges is headed by a "General Manager of Minnesota Operations." John H. Hearding, Jr., presently general superintendent of Oliver's western district, has been named to the position. John Chisholm, formerly general superintendent of Oliver's eastern district, was appointed "Assistant General Manager of Minnesota Operations." Other personnel assignments in the managerial group will be announced later.

ALSO . . .

Inland Steel Co. recently dedicated its huge mining operation near Atikokan, Ontario, which currently is producing 750,000 tons of iron ore annually. The project will reach 3,000,000 tons per year by 1969 and is being operated by Caland Ore Company, Ltd., a subsidiary of Inland. Ore is being mined by the open pit method until underground development, already under way, permits underground mining to start in 1963. When the operation reaches 3,000,000 tons of ore annually, Caland will supply one-third of Inland's iron ore needs and will be the steel company's largest single source.

Industrial Distributors (1946) Ltd., a South African company which markets the industrial diamond output from African mines, has offered to provide the diamond drill stones required for the exploratory phase of the "Mohole Project"—an attempt by a group of American scientists to drill through the Mohorovicic discontinuity which bounds the interior of the earth. Christensen Diamond Products Co., Salt Lake City, Utah, has offered to cooperate by producing drill bits with the diamonds supplied from South Africa. Purpose of the project is to obtain continuous samples of cores of the rock layers beneath the deep ocean for scientific purposes. End product of this grand-scale experiment will be advanced engineering knowledge about how to do deep drilling at sea, and scientific knowledge about the history and structure of the earth.

A new 200-unit non-recovery coke oven installation is being constructed for the New York Mining and Manufacturing Co. at Calvert City, Ky. Mitchell-type ovens, which combine the rectangular shape of by-product ovens with the non-recovery simplicity of the early beehive units, will be built.

National Gypsum Co. has started construction of a large gypsum plant at Port Tampa, Fla. The multi-million dollar facility will be supplied with ore by ship from the company's Nova Scotia gypsum deposits.

Mexico still led the world's silver producing countries last year, its production totaling 43,200,000 troy ounces.

The TVA board of directors has authorized a second generating unit at the Paradise, Ky., steam plant. This will run the plant's rated capacity to 1,300,000 kw. The second unit is scheduled to be in service by the fall of 1963, within one year after completion of the first unit. While no additional units have been authorized beyond these two, TVA has said the plant could be expanded to four units.

Christening ceremonies for a new 3200-hp towboat, the Albert F. Holden, recently took place in Pittsburgh. The new vessel was built by Dravo Corp. for Island Creek Fuel & Transportation Co., subsidiary of the world's third largest coal producer, Island Creek Coal Co. Named in honor of Albert Fairchild Holden, one of the founders of the parent company, the vessel will operate in Ohio river coal trade between Cincinnati, Ohio, and Pittsburgh.

Marquette Cement Manufacturing Co. will continue its concentration on plant modernization rather than on expansion. Its annual report presents the details of $9,500,000 worth of cost-saving improvements to be completed during 1960 alone. This program is in line with Marquette's continuing observation that modernization rather than expansion is the sound route to improved earnings in the cement industry at present. According to the company's projections, total producing capacity of the industry in continental United States will reach 439,000,000 bbls by 1961, but cement use will be only 329,000,000 bbls by that time. "This indicates an operating rate of only 75 percent, which is lower than desirable for the cement business," according to the report which concludes that, "If no more new capacity were to be built after 1960, and 1964 cement use rose to the 369,000,000 bbls shown in our study, the operating rate then still would be only 84 percent."

Bituminous coal production will reach a level of 431,000,000 tons in 1960, a gain of about five percent over last year's output, according to estimates made by the National Coal Association's Market Forecast Committee. Increased demands by the steel industry are expected to account for the biggest increase in coal's market.

Pan American Sulphur Co. has opened its new bulk sulphur storage and building facility at Tampa, Fla. The 50,000-ton dry bulk and liquid sulphur shipping installation stockpiles sulphur from the company's mines at Jaltipan, Veracruz, Mexico.

American-Marietta Co. has purchased Fry Coal & Stone Co., Mercersburg, Pa. It will operate as a division of American-Marietta. The acquisition also includes two concerns associated with Fry-Garbart Construction Co. and Vesco Corp. The Fry group's operations include eight quarrys supplying concrete aggregates, road stone, and bituminous aggregates for road construction in Pennsylvania, Maryland, and West Virginia, and a coal mining operation serving utilities in Pennsylvania and Maryland. Management of Fry will continue under leadership of Leonard S. Fry, founder and president.

Some 22,000 acres of submerged Outer Continental Shelf lands off the coast of Louisiana containing salt deposits were recently offered for competitive leasing. It was the first leasing of salt deposits in the Outer Continental Shelf. Lands involved are already under Federal oil and gas lease and under separate lease for sulphur development; thus leasing of the lands for salt development will result in production of four commodities. Leasing of the areas is being handled under a 1956 agreement between the Federal Government and the State of Louisiana. Revenues will be held in escrow pending solution of the Federal-State boundary dispute now pending before the U. S. Supreme Court.

Fly ash, a by-product of coal burned at TVA steam plants, will be used in the concrete construction of TVA's new Paradise steam plant in western Kentucky.

Looking for more lead and zinc consumption over the next few years, St. Joseph Lead Co. is boosting the lead capacity of its Herculaneum, Mo., smelter from 100,000 tons to 150,000 tons annually by 1962.

NEWS and views

Merger Consummated

Federal Uranium Corp. and Radorock Resources, Inc., have merged into Federal Resources Corp., as approved recently by shareholders of both companies. Shares of the predecessor companies are being exchanged for shares in Federal Resources Corp. on a share-for-share basis. The new company, which will operate uranium, silver and beryllium ventures formerly controlled by the two corporations, will have headquarters in Salt Lake City. Federal Uranium and Radorock have had several common interests in the past, including joint participation on several operations. Principal properties of the merged company include: the Radon uranium mine in southeastern Utah, a 60 percent interest in a uranium mill and adjacent uranium ore bodies in the Gas Hills area of Wyoming; control of the Conjecture silver mine in northern Idaho, which is in the advanced development stage, and equal interests in two companies formed jointly with others to enter the beryllium field. The merged corporation has a present value of more than $20,000,000 based on discounted earnings from uranium sales through 1966 plus other assets.

$4,500,000 Agreement Signed

Texas Gulf Sulphur Co. and Delhi-Taylor Oil Corp. have signed an agreement whereby Texas Gulf will acquire and commercially develop Delhi-Taylor's potash properties at Cane Creek near Moab, Utah. Delhi-Taylor will retain a 25 percent net profit interest in the properties and will receive guaranteed advance net profit payments of $4,500,000 over 4½ years. A first payment of $500,000 has been received by Delhi-Taylor. Texas Gulf Sulphur will have until January 1, 1961 to complete an examination of the technical aspects of the project and it is assumed that commercial development will begin upon completion of this work. Delhi-Taylor's extensive southeastern Utah potash properties have been under investigation since 1953, during which time the company has maintained a continuous evaluation program. As a result of this program, two large potash reserve areas have been discovered and demonstrated through core drilling. In particular, the Cane Creek anticline area indicates a long-term, high-grade potash reserve that promises to become a major domestic source of this material.

Hecla and Callahan Swap Stock

Hecla Mining Co. is reducing its ownership in the Bunker Hill Co. from 19 to about 13 percent through an exchange of stock with Callahan Mining Corp. The transaction calls for Hecla to exchange 68,000 shares of its Bunker Hill stock for 77,000 shares of Hecla held by Callahan. In addition, Callahan will purchase 32,000 shares of Bunker Hill from Hecla for $11 per share. The move was taken by Hecla to reduce its 300,000 share holdings, deemed out of proportion to its other assets, in Bunker Hill. Cash proceeds from the deal will help finance Hecla's participation in exploration that may lead to development of properties of the newly organized Ruby Hill Mining Co. in Nevada's Eureka mining district.

Trona Production to Be Upped

Intermountain Chemical Co. is planning an expansion program for its underground trona mine and processing plant facilities near Green River, Wyo. As a result of the expansion, which calls for expenditures of about $4,000,000, output of high purity soda ash will be increased 200,000 tons per year for a total production in excess of 700,000 tons. One part of the program will consist of installing additional new equipment for continuous mining of trona and another part will result in modification of the refining process. For mining the trona, the company has installed a specially designed augur, similar to those used in coal mining, which eliminates blasting, drilling and mucking. Hydraulic mining had been attempted but operating problems had forced abandonment of this method.

Kennecott to Sink Winze

Development work is to be undertaken by Kennecott Copper Corp. at the Burgin shaft in the East Tintic District of Utah. Bear Creek Mining Co., a Kennecott subsidiary, has been conducting exploration work in the area for over three years. This work included sinking of the 1100-ft Burgin shaft and underground exploration from the Burgin consisting of crosscutting on the 1050-ft level and diamond drilling below it. Results of the exploration work have led Kennecott to obtain permission from the Utah State mine inspector to sink a winze to develop ore found by drilling below the 1050. Although details of the development work have not as yet been disclosed by the company, it is reported that the initial work will be to sink the winze about 500 ft at a 30° angle, which would place its bottom below water level of the district. These activities are of interest to mining companies of the district, since the mines have generally been idle for several years. While leases, under which Bear Creek has been working, are being acquired by the parent company, Bear Creek will continue exploration on leased ground of the district.

Hydraulic Mining of Gilsonite

The almost universal exposure of narrow Gilsonite ore veins near or on the surface at American Gilsonite Company's mines near Bonanza, Utah,

(*Continued on page 108*)

(*Continued from page 107*)

has provided the basis for a new method of mining. Formerly, ore was removed by high-pressure hydraulic jets advancing along drifts underground, which cut away and partially pulverized the mineral in one operation. Timbered drifts were essential for protection of underground workers.

The new method uses truck-mounted oil well drilling equipment supported on a platform immediately above the veins. Vertical holes are drilled through the center of the ore vein to an intersecting bottom drift. Hydraulic high-pressure nozzles are then substituted in place of the drill bits and lowered to the bottom drift. Water, delivered at 2500 psi against the walls of the hole, as the nozzles are slowly rotated and gradually pulled back to the surface, tears the ore free and it falls into the drift below. At that point, a stream of low-pressure water carries the ore as a slurry by gravity-flow to other handling facilities in the mine which eventually raise the ore to the surface. This system eliminates the men working along the underground faces.

The company proposes to monitor the hydraulic phase of the operation by closed-circuit television cameras at the level of the high-pressure cutting nozzle. The camera would be suspended by a cable from the surface into the open area behind the face of the vein being cut. The operator on the ground would be able to guide the hydraulic nozzle in accordance with the view provided by the camera.

American Gilsonite recently announced that it will about double production from its Grand Junction, Colo., refinery in order to meet increasing demands for Gilsonite fuel. Daily output, when the expansion is completed, will include about 350 tons of coke, 1600 bbl of gasoline and 1300 bbl of railroad fuel.

ALSO . . .

Gold mining operations are being resumed at the Teressa mine near Victor, Colo., by Golden Cycle Corp. The Teressa, which is near the Golden Cycle and Vindicator mines, has not been worked for 18 years.

Aluminum reduction capacity is being increased 25 percent at The Dalles, Ore., reduction plant of Harvey Aluminum, Inc. One of six primary aluminum producers in the nation, the company produced about 58,000 tons of primary aluminum at the Dalles facility during 1959.

A 1000 tpd asbestos mill is under construction at the ABC open pit mine of Clute Corp. near Napa, Calif. The mill, which is being built in four 250-tpd capacity units and is slated for completion in August, will process ore by a dry milling method using air pressure for movement, separation and product classification. Pilot plant studies by Clute indicate asbestos fiber recoveries up to about 23 percent by using air separation, as compared to industry recoveries of from six to ten percent. The company claims the Napa asbestos ore reserves are the largest in the United States. A recent geological survey at the mine disclosed about 4,000,000 tons of proved ore, 7,000,000 tons of probable, and 200,000,000 tons of possible ore reserves.

Inspiration Consolidated Copper Co. is reported to have acquired the Miami, Ariz., smelter of International Smelting & Refining Co. The smelter treats concentrates and cement copper from Inspiration, as well as on a custom basis for other area producers, and is slated to handle concentrates from Inspiration's Christmas mine which is due to be in production late in 1961.

A 50 percent increase in steel ingot capacity will result from an $8,000,000 addition under construction at the Pueblo, Colo., plant of Colorado Fuel & Iron Corp. Scheduled for completion in February 1961, the addition will include an oxygen converter for steel making and capable of producing about 70,000 tons of ingots per month. Present capacity of the Pueblo plant is about 150,000 tons per month, all of it from open-hearth furnaces.

Calera Mining Company's Garfield cobalt refinery in Salt Lake City is to be sold to Minerals Engineering Co., who will use the facilities for production of vanadium pentoxide. Minerals Engineering proposes to treat vanadium bearing ferro-phosphorous, which is a so-called intermediate product tapped from elemental phosphorous furnaces, to produce upwards of 2,000,000 lb per year of 98 to 99 percent V_2O_5. Plans of the company call for obtaining ferro-phosphorous containing about 10 percent vanadium from the Pocatello, Idaho, plant of Food Machinery & Chemical Corp. Minerals Engineering will utilize a heat-chemical extraction method in what is believed to be the first effort in the United States to recover vanadium from phosphate ores.

A drilling and blasting symposium will be held at Colorado School of Mines, Golden, Colo., October 17–19. Sponsored by the mining departments of University of Minnesota, Pennsylvania State University, and Colorado School of Mines, it is third in a series of ten devoted specifically to production drilling and blasting. The agenda includes papers of both practical and academic interest.

A five-year development program is planned for the Anaconda Company's Butte, Mont., underground mines. Expenditures of $11,000,000 are contemplated to bring about mining of high grade copper ore reserves at deep levels and to complete a new underground central pumping station. Kelley mine No. 1 shaft will be extended and made a central hoisting shaft to bring up ore from deep levels of the Mountain Con, Steward and Leonard mines. Ore will be trammed to the Kelley through large haulageways between it and the Mt. Con and Steward on the 4400-ft level and the Leonard on the 3900-ft level. The Tuolumne shaft will be enlarged to make it a central pumping shaft for removal of water from all the mines. Work is underway on the Tuolumne and Steward projects and is due to start later this year on the Kelley.

The program will make available for economical operation large reserves of high-grade, vein-type copper ore which, in combination with Kelley mine block caving and Berkeley open-pit production, will assure a balanced operation in Butte for decades. These plans envision ultimate utilization of all three types of copper ore reserves.

Dawn Mining Company's uranium mill contract with the Atomic Energy Commission has been extended to December 31, 1966. The new contract replaces the original agreement which would have expired March 31, 1962. Dawn operates a 400 tpd uranium processing mill at Ford, Wash., and the Midnite mine on the Spokane Indian Reservation. The mill will continue to provide an outlet for other producers in the area who had reserves developed prior to November 24, 1958.

A rock physics and rock mechanics information center will be established at Colorado School of Mines. The center will collect, classify, and evaluate information about the behavior of rock subjected to various physical conditions. It will be operated jointly by the school's Research Foundation, the School of Mines and Lawrence Radiation Laboratory of the University of California.

A symposium on surface mining practices will be conducted by the University of Arizona's College of Mines, October 17–18 at Tucson. The tentative program will include the following subjects: open pit mining, strip mining, quarrying, transportation, drilling and blasting, and miscellaneous subjects of interest.

Gold Eagle Mines, Inc., has been authorized by the Office of Minerals Exploration, Department of the Interior, to spend $20,660 exploring for lead, zinc, and copper in Esmeralda County, Nev., toward which the Government will contribute one-half.

Full scale concreting operations will commence June 17 at Glen Canyon damsite in Arizona following placement of the first 12 cu yd bucketful by Secretary of the Interior, Fred A. Seaton. In connection with concreting over the next three years, about 3,000,000 bbl of cement will be trucked 188 miles from a plant at Clarkdale, Ariz., in what is believed to involve a long haul trucking job unequaled in construction history. Total truck miles for this haul have been calculated to be in excess of 137 million. During the peak construction period, an especially constructed cement truck rig 60 ft long and carrying 27¾ tons will leave Clarkdale every 30 to 40 minutes around the clock. Since construction was started in 1956, over 3,750,000 yd of rock have been excavated at the site, and expenditures for the project thus far have been about $63,000,000.

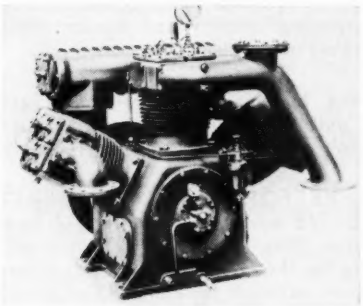
Construction has begun on a $5,000,000 plant to produce white cement at the Crestmore, Calif. facilities of Riverside Cement, division of American Cement Corp. The plant, slated for completion in the spring of 1961, will have an annual capacity of 250,000 bbl.

A $2,000,000 leaching and precipitation plant for the production of metallic copper is planned by Bagdad Copper Corp. at its operations near Bagdad, Ariz. The company's decision is the result of pilot plant work which demonstrated that copper ores from its open pit mines can be successfully treated by the leach and iron precipitation method. Bagdad expects to have the plant operating about May 1961.

Vanadium will be recovered at a processing plant that the Susquehanna Corp. is building at Edgemont, S. D. Substantial amounts of vanadium and other rare metals are contained in ores from which the company is recovering uranium. The plant's production for the next five years has already been contracted for.

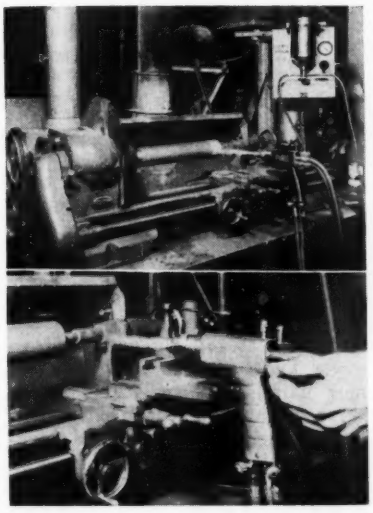
manufacturers forum

ALL-PURPOSE AIR COMPRESSORS delivering from 174 to 338 cfm have been introduced by Atlas Copco, 545 Fifth Ave., New York 17, N. Y. Designated the CR series, the machines are designed for heavy duty, three shift operations in mines as well as other industrial activities.



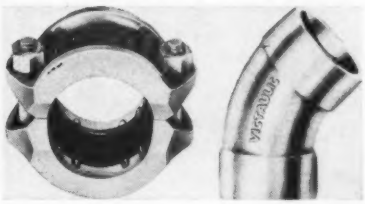
They are two-stage, single-acting units featuring air-cooled cylinders and cylinder heads. The manufacturer says this design facilitates the flow of lubricating oils and eliminates condensation. Equipped with water-cooled intercoolers, the machines are rated for working pressures up to 125 psi. The CR series, with weights ranging from 1500 to 2000 lb can be either permanently installed or operated on skid mounts.

A POWDER METAL SPRAYING UNIT, the Model D Spraywelder (top picture) features a high spray rate (over 12 lb per hr) and an exceptional deposit efficiency (up to 95 percent), according to Wall Colmonoy Corp., 19345 John R St., Detroit 3, Mich. Simplification of controls is



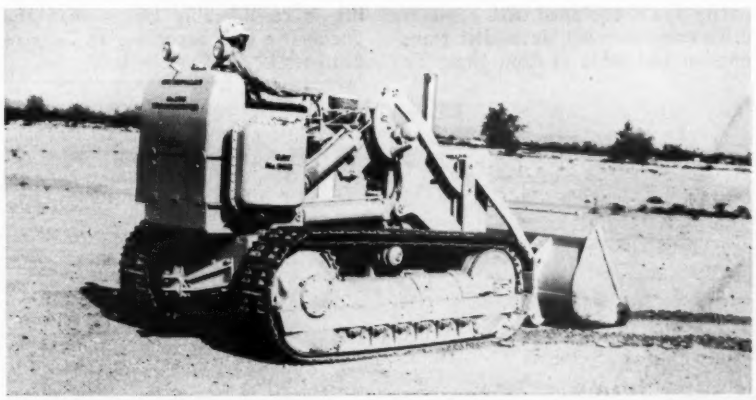
said to be the major physical improvement. Former trigger and powder flow control have been combined into one simple positive-acting operating valve (lower picture). Elimination of the trigger mechanism is said to substantially reduce the space requirement, permitting a more compact pistol design and leading to a principal advantage of reduction in weight.

FOR CONNECTING PLAIN END PIPE, Victualic Co. of America, P. O. Box 509, Elizabeth, N. J., has developed the Plainlock method of piping. This method consists of Plainlock couplings and fittings, for use with plain or beveled end pipe. Couplings are designed with two bolts for fast



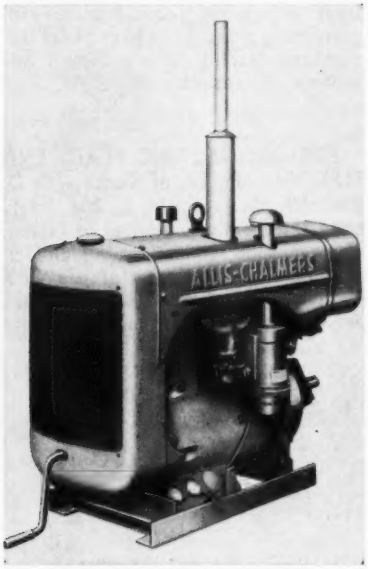
installation and are fitted with hardened stainless steel grips that engage the pipe ends and lock them together. The fittings are said to be engineered with long radii "Full-Flow" sweeps for good hydraulics and minimum friction loss. The couplings and fittings are available in sizes 1, 2, 2½, 3, 4, and 6 in., and reportedly do not require pipe and preparation of any kind.

A CRAWLER MOUNTED LOADER, the 955 Series H Traxcavator, has been announced by Caterpillar Tractor Co., Peoria, Ill. It features a power shift transmission, is powered by a compact, turbocharged four cylinder diesel engine, and has a bucket with capacity increased from 1½ cu yd (on the old model) to 1¾ cu yd. The new power shift transmission reportedly permits single lever shifting through all phases of the work cycle, and a total of four work speeds are available to the operator, there being two gear speeds in both the high and the low work ranges. Superior digging action and a 23 percent increase in lifting capacity are said to result from a new hydraulic system. Other improvements announced in this new model are: an increase in track rollers from five to six; adop-



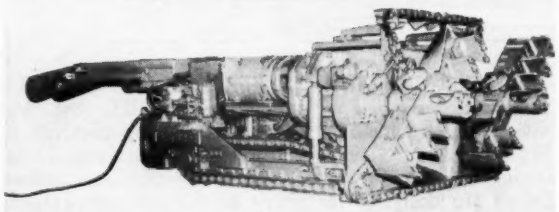
tion of a heavy duty under-carriage with welded track guiding guards and lifetime lubricated rollers as standard equipment; a 52 gal capacity fuel tank. Retained, job-proven features include automatic bucket positioner and kickout; 40 degree tilt back and 47½ degree tilt at maximum lift; three grouser track shoes and hydraulic track adjusters.

A 4-CYCLE, 4-CYLINDER, 138-CU IN. PISTON DISPLACEMENT UNIT that develops 39 bhp at 1800 rpm has been added to Allis-Chalmers line of gasoline and natural gas engines. Known as the G-138, the new engine is a companion to the company's G-149 and G-226. The engine weighs 402 lb, and the power unit 622



lb. The unit is 46 in. long, 18-15/16 in. wide and 30½ in. high to top of radiator. Its claimed operational advantages are maximum power and fuel economy.

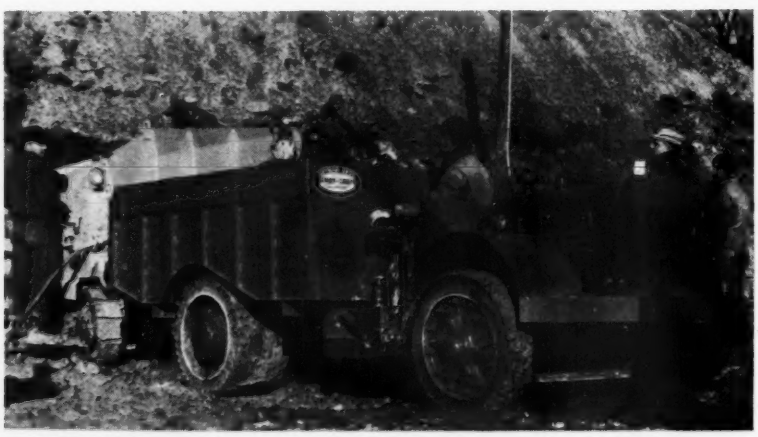
CONTINUOUS MINERS WITH DUAL-RANGE HEIGHT ADJUSTMENT THROUGH 18 IN. have been developed by National Mine Service Co., Pittsburgh, Pa. as an addition to the Marietta series. The machines, crawler-mounted, boring-type units with capacities of approximately 8 tpm, can make a variety of height adjustments hydraulically, within either of two 12 in. ranges, from the operator's station and are said to do it in a matter of minutes. The adjustments include top and bottom trim chains, positioning rotor arms, and adjusting trim jacks. Shifting from one range to another is a mechanical adjustment. Other design features reported are separate motors for each of the two cutting heads and the hydraulic system; extremely broad throat; maintenance accessibility; and advanced support design providing stability and concentrating mass against the working face without the aid of jacks.



WIRE LINE CORE BARRELS of a new design introduced by E. J. Longyear Co., 76 S. 8th St., Minneapolis 20, Minn., are said to recover cores up to 25 percent larger in diameter than the original line of barrels. The new "Series 10" increase core size to 15/16, 1-5/16, 1-23/32 in. for AX, BX, and NX Wire Line barrels respectively, while drilling the same size holes as the old designs. Narrower kerfs of bits used with the new barrels reportedly reduce the carat weight of diamonds by 10 to 20 percent, and help to increase penetration speed and bit life. In deep holes, Wire Line reportedly saves one to four hours at the end of each core run by eliminating the long, hard "pull". The drill string is withdrawn only when the bit must be replaced.

PREFORMED EDGE REPAIR CUFFS by Rema-Tech, Inc., 2 Park Ave., New York 16, N. Y., are said to be the latest cold vulcanized repair materials for damaged or frayed conveyor belt edges. It is reported the simplicity of application allows repairs right on the spot without costly or heavy equipment. Because of the quality of repair, it is said longer service from the conveyor belt will result.

APPROVED BY THE U. S. BUREAU OF MINES, and manufactured by Getman Brothers, South Haven, Mich., the Getman Ore Carrier, Model CD-4-T, has a ten-ton carrying capacity and is equipped with planetary drive axle assembly, automatic transmission and mine cushion tires. The tire, which is a solid type, is said to have very nearly the same flexibility as a pneumatic tire, and traction equal to or better than the pneumatic type. For mining use, the special tire's life is considerably longer than the pneumatic tire, according to Getman Brothers.



A READY-TO-SHIP SPARE PARTS KIT has been developed by Exide Industrial Div., The Electric Storage Battery Co., Rising Sun and Adams

Aves., Philadelphia 20, Pa., for its line of vertical motor-generator chargers used with mine locomotive and electric industrial truck batteries. Containing parts that commonly need to be replaced after long use in electric motor equipment, the kit, reportedly, provides extra assurance of uninterrupted charging service. It comprises a full set of brushes, two bearings and a fuse packed in a clearly labeled corrugated package.

ANNOUNCEMENTS

C. M. Donahue and **E. W. Merry,** vice presidents of the **Mine Safety Appliances Co.,** have been

C. M. Donahue

E. W. Merry

elected to new posts in the international and the domestic operations of the company. Donahue becomes president of the M.S.A. International Division, in addition to his vice presidency with the parent company, and Merry becomes executive vice president in charge of domestic operations.

Donahue, with the company since 1927, was manager of the Mining Department from 1946 and manager of the International Division from 1950 until he became a vice president in 1953. He is a past president of the Coal Mining Institute of America and of the Mine Rescue Veterans of the Pittsburgh District.

Merry joined M.S.A. in 1936 as market research manager, and during World War II was Government Department manager. In 1946 he became director of sales planning, and in 1957, vice president, Industrial Products Group. He is a member of the American Society of Safety Engineers, and of Veterans of Safety.

W. R. Timken was elected President of **The Timken Roller Bearing Co.,** succeeding **D. A. Bessmer** who resigned because of ill health. Timken started with the company in 1935, was elected a Director in 1936 and a Vice President in 1941, and has served on the Finance, Executive and Policy Committees of the company.

Elected to the Board of Directors of The Timken Roller Bearing Company were **G. L. Deal,** Secretary-Treasurer; **F. J. Reeves,** Vice President in Charge of Sales, and **Henry Tobey,** Vice President in Charge of Manufacturing, Bearing and Rock Bit Divisions.

Wesley I. Nunn, advertising manager of **Standard Oil Company (Indiana)** for more than 23 years, retired recently at normal retirement age of 65. **Robert B. Irons,** who joined the company 24 years ago and has been assistant advertising manager since 1957, will be promoted to advertising manager. **Karl Mueller,** with Standard 20 years and district manager at Saginaw, Mich., since 1957, will be advanced to assistant advertising manager of the company at Chicago.

Victor Equipment Company, San Francisco, has acquired **L&B Welding, Inc.,** Berkeley, Calif., manufacturer of machines for the rebuilding of tractor track rollers, idlers and rails, according to an announcement by **L. W. Stettner,** Victor president. The new acquisition will be operated as a wholly-owned subsidiary, with manufacture to continue at the present plant in Berkeley. L&B executives **Turner G. Brashear, Forest Leader** and **Clifford Leader** will remain in management capacities.

National Mine Service Co. has established an Alabama Division, with a warehouse and sales headquarters in Birmingham to service the mining industry of Alabama and neighboring states. It is the eleventh division set up by the company. **P. L. Hubbert,** district manager of the western Kentucky division, will be in charge of the distributor products section assisted by sales representative **C. R. Bucklin. J. J. Ward,** sales engineer, will serve the territory for the equipment section and **J. P. Barnes** will be warehouse manager.

Thomas P. Applewhite has been promoted from assistant manager to manager of conveyor products sales for **United States Rubber Co.,** to succeed **Robert E. Spoerl** who has resigned. Applewhite has been with the company's mechanical goods division since 1947, specializing in conveyor installations for underground and strip coal mines, fluorspar mining, and the limestone industry.

American Hoist & Derrick Co., St. Paul, Minn., has announced its acquisition of **Industrial Brownhoist Corp.,** Bay City, Mich., through purchase of outstanding Brownhoist stock. American will operate the purchased company as a wholly owned subsidiary with continuation of its operations at Bay City. The range of products made by both companies are complementary.

Allis-Chalmers, Industries Group, has announced a series of related personnel promotions in their North Central and Midwest regional and district offices.

Charles F. O'Riordan, manager of the Midwest region with headquarters in St. Louis, has been named as manager of the North Central region with headquarters in Chicago. He will be succeeded by **R. E. Morris** who was serving as St. Louis district manager. Morris in turn will be succeeded in his recent post by **J. A. Sudduth** who is being transferred to St. Louis from Grand Rapids, Mich., where he was district manager. **William S. Wright,** who has been a sales representative in Grand Rapids district since 1952, succeeds Sudduth as manager of that district.

CATALOGS & BULLETINS

VIBRATORY FEEDER. *Syntron Co., 703 Lexington Ave., Homer City, Pa.* Complete descriptions, data, and specifications are available along with 90 illustrations of the company's line of small, heavy and extra-heavy-duty standard electromagnetically vibrated feeders. There is also data on three pneumatically and hydraulically vibrated feeders for explosive materials, dangerous atmospheres or for light, fluffy materials.

EDDY CURRENT COUPLING. *General Electric Co., Schenectady 5, N. Y.* Bulletin GEA-6885 provides extensive information on GE's Kinatrol line of eddy current coupling adjustable speed drives for 5 to 100 hp. Information on the operating principle of this coupling is given, as well as data on torque capabilities, regulation and operation of the entire packaged drive which includes the main drive unit, control enclosure and the operator's control.

ALUMINUM WHEELS. *Aluminum Co. of America, Room 738 Alcoa Bldg., Pittsburgh 19, Pa.* The brochure, "Weigh the Facts," outlines the advantages of aluminum forged disc wheels. New data on extra payload, longer tire life, and reduced maintenance costs are detailed.

LOADING AND STORING BULK MATERIALS. *Link-Belt Co., Dept. PR., Prudential Plaza, Chicago 1, Ill.* Folder 2721 describes three models of Jetslingers—machines equipped with short, high-speed belt conveyors for hurling free-flowing bulk materials into areas inaccessible by other mechanical means. Both the suspended, swiveling unit and the two portable wheel-mounted units are described and illustrated. They are available in belt widths of 14, 20 and 28 in., and have capacities of up to 700 tph for materials weighing 50 lb per cu ft.

CORROSION RESISTANCE CHART. *OPW-Jordan Corp., 6013 Wiehe Road, Cin-*

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cinnati 13, Ohio. Chart J-CRC lists over 150 different chemicals and their recommended usage with ductile iron, iron, steel, 316 and 304 stainless steel, monel, brass, bronze, copper, aluminum and plastisol plastic. Bulletin also shows which gasket materials are needed for various chemicals when Kamlok Quick Couplers are used and which O-ring materials are needed when swivel joints are used with these chemicals and compounds.

27-TON REAR-DUMP TRUCK. *International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill.* Catalog (CR-743-I) describes International Model 95 Payhauler, a 27-ton, rear-dump, off-highway truck. The model is available in a standard or quarry body and has a six-cylinder diesel turbocharged engine which develops 375 hp at 2100 rpm.

MOLYBDENUM PRODUCTS. *Climax Molybdenum Co., Division, American Metal Climax, Inc., 1270 Avenue of the Americas, New York 20, N. Y.* A non-technical, descriptive booklet on Climelt molybdenum products is now available for those executives, purchasing agents, and others with a general interest in the unique combination of properties found in these materials. Entitled "Climelt Molybdenum and Molybdenum-Base Alloys," it gives full details on various sizes, forms, use conditions, tolerances, weights, and identification methods of these products now available for commercial use.

CRAWLER TRACTOR. *Caterpillar Tractor Co., Peoria, Ill.* Form 33443 covers the latest improvements to Caterpillar's D9 Series E Tractor. Claimed to be the largest single-engine track-type tractor in production today, the 335-hp D9 Series E is available with three different transmissions—direct power, power shift, and torque converter. Advantages, operating characteristics and maximum drawbar pounds pull available with each type are given.

MOTOR-GENERATOR CHARGERS. *Exide Industrial Div., The Electric Storage Battery Co., Rising Sun and Adams Aves., Philadelphia 20, Pa.* Form 5845 contains comprehensive instructions on the daily operation and long range preventive maintenance of the automatically controlled Exide Vertical motor-generator chargers. A wiring diagram simplifies the seven-step installation of this equipment.

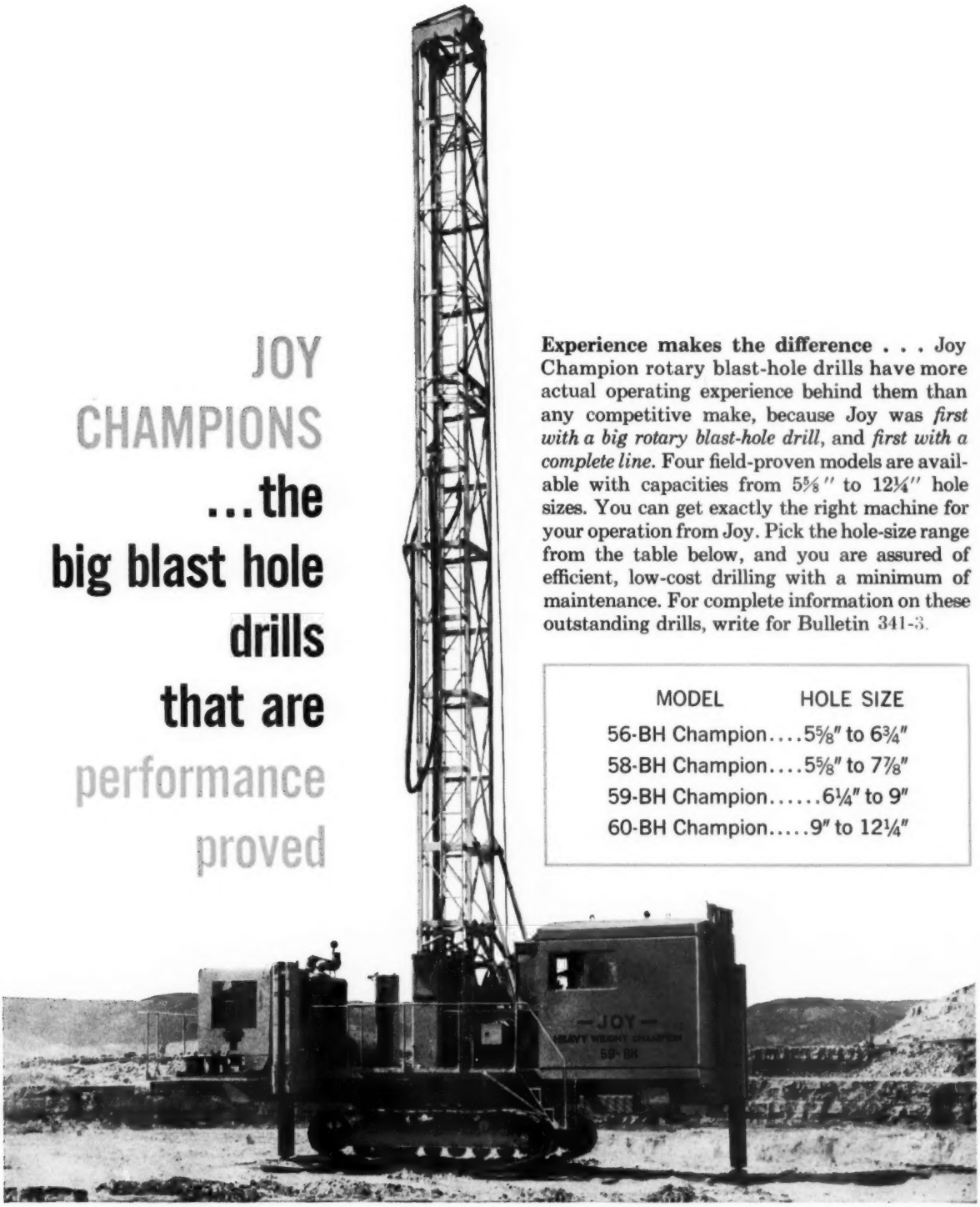
WIRE ROPE WEIGHTS AND STRENGTHS. *Macwhyte Wire Rope Co., Dept. P. R., Kenosha, Wis.* Bulletin No. 6025 is a condensed catalog listing of new up-to-date weights and strengths of both Improved Plow Steel (Monarch Whyte Strand), and Extra Improved Plow Steel (Premium Whyte Strand), and includes a general explanation and description of wire rope constructions and types plus helpful information for ordering wire rope.

PRODUCTS FOR THE PLANT. *Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.* Form 223 describes various compressors, pumps, steam condensers, steam-jet ejectors, air hoists, and air and electric tools for plant use. Representative machines in each line are illustrated and design features noted. Also included are recommended applications of each kind of equipment as well as size and capacity ranges.

BELT CONVEYOR IDLER. *Joy Mfg. Co., Oliver Bldg., Pittsburgh 22, Pa.* The Joy Series 200 Limberoller belt conveyor idler, described by the company as an improved version of the original two-bearing catenary idler introduced by Joy in 1953, is the subject of Bulletin LD-111. The Limberoller idler consists of a series of neoprene discs molded to a neoprene-covered, flexible steel wire cable suspended from two end-mounted bearings. According to the manufacturer, cable strain on the new model is reduced by free swiveling bearing mounts and extra reinforcement between end discs. Bulletin contains complete specifications, details on construction features, installation photographs and application instructions.

Index to Advertisers

JOY CHAMPIONS ...the big blast hole drills that are performance proved



Experience makes the difference . . . Joy Champion rotary blast-hole drills have more actual operating experience behind them than any competitive make, because Joy was *first with a big rotary blast-hole drill*, and *first with a complete line.* Four field-proven models are available with capacities from 5⅝″ to 12¼″ hole sizes. You can get exactly the right machine for your operation from Joy. Pick the hole-size range from the table below, and you are assured of efficient, low-cost drilling with a minimum of maintenance. For complete information on these outstanding drills, write for Bulletin 341-3.

MODEL	HOLE SIZE
56-BH Champion	5⅝″ to 6¾″
58-BH Champion	5⅝″ to 7⅞″
59-BH Champion	6¼″ to 9″
60-BH Champion	9″ to 12¼″

EQUIPMENT FOR MINING... FOR ALL INDUSTRY

JOY

Core Drills | Slushers | Rock Bits | Drillmobiles

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

Now—more light, less weight, longer life with

NEW EDISON MODEL S ELECTRIC CAP LAMP

MSA announces another new *high* in lighting efficiency in the world's most popular cap lamp. Increased light output of the new Edison Model S Lamp assures greater safety for the miner, more tons per shift for the operator. Let's face a fact: Dimness costs money. *Fair* lighting does only a *fair* job. Maximum lighting—the brilliant, unfailing Edison Model S kind—helps get jobs done with top speed and safety. And the simplified method of charging new Model S Batteries—with the AUTOMATIC LOW-VOLTAGE SYSTEM—is convenient, thrifty and highly efficient. Lets miners take their lamps and rack them—quickly—without loss of time or waste motion. When planning a new lamphouse installation or modernizing your present one, call in the MSA Representative. MSA can help you solve your lighting problems.

Newly issued U.S. Bureau of Mines Approval 6D-31, April 16, 1959.

MSA SAFETY EQUIPMENT HEADQUARTERS

MINE SAFETY APPLIANCES COMPANY • 201 North Braddock Avenue, Pittsburgh 8, Pennsylvania

MINE SAFETY APPLIANCES CO. OF CANADA, LIMITED • Toronto, Calgary, Edmonton, Montreal, Sydney, Vancouver, Winnipeg

Look how small the headpiece is. Weighs only a few ounces. Feels even lighter on the head. You get a clear, sharp spot every time.

Increase in working light appeals to me. This new Edison Model S gives 15% more than we ever had before. And they didn't cut their bulb service life rating to do it. The double filament bulb means we'll always have working light to finish the shift. Each filament of the Edison Model S krypton-gas-filled bulb has a 400-hour designed life.

Just watch the improvement in our safety and tonnage reports. More light. Less weight. Longer life. Even the battery's better. It has a new active material that boosts service life. They went all-out to meet the miner's needs with this one.